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# The Organic Farmer

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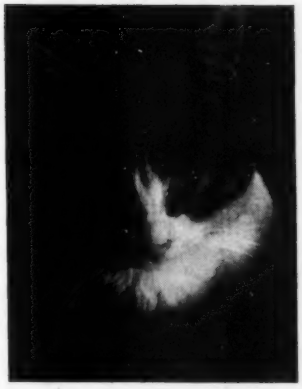
February, 1950

# *The* Organic Farmer

Farming Without Chemicals

## Contents

Volume 1, No. 7



*. . . failure as a mouser*
*(see page 41)*

### EDITORIAL

How to Farm Organically 6 *J. I. Rodale*

### ARTICLES

Champions Grow Champions 8 *Herbert C. White*
Is Any Soil Really Poor? 12 *J. Sidney Cates*
Airborne Agriculturists 14 *Frank W. Ball*
Soils and Proteins 16 *Dr Wm. A. Albrecht*
Powdered Rock Fertilizers 19 *Dr. Wm. R. Raymond*
Plants as Indicators of Soil Reaction 25 *Dr. E. E. Pfeiffer*
The Wife Is the Farmer 27 *Alden Stahr*
New York's Water Shortage 30 *J. I. Rodale*
Another Look at Trace Elements 33 *Leonard Wickenden*
It Isn't Yours to Harvest 35 *William P. Coleman*
The Nature of Soil Fertility 37 *Sir Albert Howard*
Report from the Skagit Valley 38 *Jack Van Clute*
Haying Helps 40
Stone Mulches for Strawberries 43 *William Ackerman*

### DEPARTMENTS

Letters 2
Books 40
Memos to Farmers 41
Poultry 44
Livestock 46
The Market Place 47

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*The Cover: Two yearling roosters from the Organic Experimental Farm*

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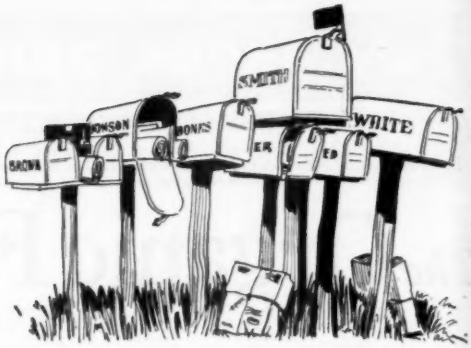
# Letters




### A Soil Scientist Speaks

Dear Sir:

I have just received from you a piece of literature advertising your magazine.

The statements that you make relative to the essential nutritional value of organic matter cannot hold up under the light of modern research, and I think it is a pity that you people feel that it is necessary to disseminate such misleading information.

GILBEART H. COLLINGS
The Clemson Agricultural College

*Ed. In answer to Professor Collings, the attention of the reader is called to the following quote from the book,* The Business of Farming, *which is reviewed on page* 40: *"Much attention has already been given to organic matter, and properly so, because among its other values it is the main source of nitrogen to most crop plants."*

### Insect Control Without Chemicals

Dear Sir:

Enclosed is a clipping from *Newsweek* telling of Prof. Leonard Haseman's theory that the best way to combat insect invasions is to build up soil fertility, thereby presenting the insect with a well balanced diet, which, incidentally, he doesn't thrive on. If you have not read this article before, you will probably find it interesting.

May I take this opportunity to express my enthusiasm for your magazine, and for your efforts on behalf of organic husbandry. I am aware that you must spend a vast amount of energy and thought on your work, and I know of no other periodicals, no other subject, so utterly stimulating and fascinating.

BETH ST. GLAIR
Galt, Ontario.

### Agronomist Warns of Overuse of Chemicals

Dear Sir:

I am enclosing a clipping from the Ottumwa (Iowa) Daily Courier reporting the statement of a government agronomist on the harm that can come from the use of chemical fertilizers.

Mr. Meldrum, the Iowa State College agronomist, does not say that chemical "fertilizers" are entirely wrong, but I think we are getting somewhere when a man from the state agricultural college in the nation's richest agricultural state will tell a group of chemical dealers that it is their duty to warn their customers to go easy with their product.

In fact, reading between the lines, and also reading Mr. Meldrum's five essential points at the end of the piece, we gather that a smart farmer would not need to use chemicals at all if he had a proper respect for his land and the health of those who consume the products of his soil.

I am glad to report that the succesful farmers in this area (where prairie farm land sells for $250 to $400 per acre) are coming more and more to rely on sound conservation and soil building practices and less and less on chemicals. But many still justify their use as a starter or shot in the arm, so to speak, and it will take time to correct this view, if indeed it can be corrected.

ROBERT FELL
Fremont, Iowa

### The Power of a Free Press

Dear Sir:

Our company started subscribing to your magazine several months ago and we have been reading it with considerable interest. We have been particularly interested in your presentations on the advantages of rock phosphate as compared with super phosphate.

From our reading we gather that many so called authorities have closed minds on the subject. In fact, we noticed that in a recent issue, one of the midwest farm magazines was actually bragging that they will not accept rock phosphate advertising.

Our company has experienced a lot of the same kind of thinking in our field and are, in our small way, trying to conduct a program of education that will make the other side of the picture available to as many farmers as possible, so that they can

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study all the facts and arrive at correct conclusions.

We wish to commend you on your efforts to acquaint the American farmer with any facts that would otherwise be withheld. One of the finest things about our country is that no group, no matter how powerful, can continue to mislead the public without being eventually exposed and the situation corrected.

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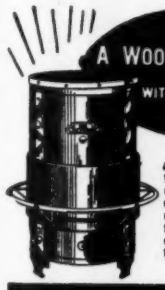

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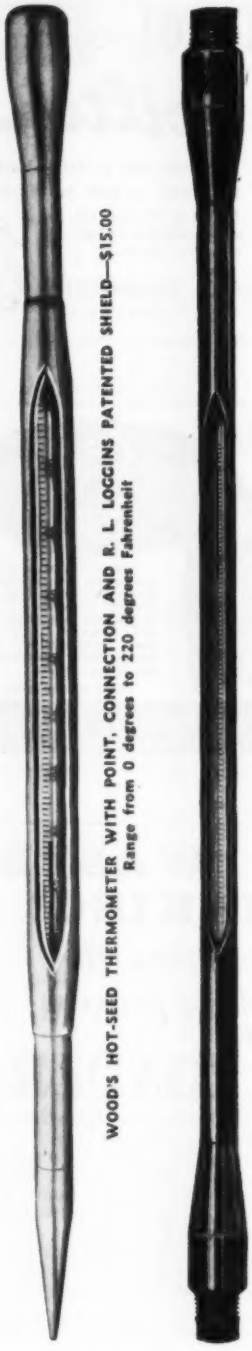
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a day to clean out a poultry house and load one load and get it back to the farm. I estimate that it costs me $3.00 per ton to haul it. Commercial fertilizer is selling around here for from $47 to $55 per ton and Milorganite costs $65.

The question is, what should I pay these poultrymen for their manure?

J. C. Spooner
Arden, N. C.

*Ed. Poultry manure can usually be bought for less than it is worth. Some poultry raisers accept the cleaning out of the house as pay. In any case, you should not pay more than several dollars a ton for it. You might be able to work out an arrangement whereby you would substitute clean litter for the manure you take out. You would then have a good chance of getting the manure free.*

## Successful Farming—Organically

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For the past fifteen or twenty years I have been more or less blindly rebuilding the organic matter in our soils.

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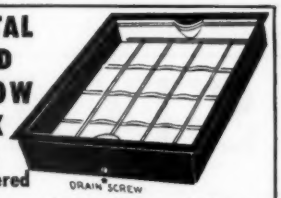


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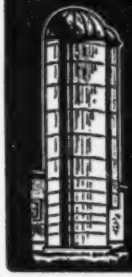

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I took up, rather intensively, the study of this newer concept of agriculture. I have found *The Wheel of Health, An Agricultural Testament, The Soil and Health, Humus and the Farmer, The Living Soil, Pay Dirt, Forest Soils* (by Lutz and Chandler) all very edifying and stimulating. I have found much of interest and some of value in *Organic Gardening* and read *The Organic Farmer* with interest.

We have been practicing much of what we are learning with considerable success. We raise dairy heifers from calves to freshening on a variety of legumes and grasses in pasture and in pen stables open to the south in winter. We now have 75 head. We rely on poultry manure and compost, rock phosphate, limestone and deep rooted legumes and grasses for fertility. Our orchards have orchard grass sod, brought-in mulch and occasional winter manure on the sod.

No feed is bought—all is produced on the place. No mature animals are brought in — only calves or young heifers from clean herds. We have an accredited herd. We use a succession of young bulls and have surprisingly little difficulty breeding our heifers. The heifers we have sold have given uniformly good satisfaction in the dairies that have bought them.

E. STUART HUBBARD
Poughkeepsie, N. Y.

**Quality, Not Quantity**

Dear Sir:

Many thanks for your article on "Pushing Cows" in the December issue.

For forty years I ran a goat dairy and when a goat keeper would ask me how much my heaviest milker gave, I would reply, "I don't know and I don't care. I just try to keep my goats in good condition so I can get healthful milk."

A. J. ROBERTS
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# With the Editor

## *How to Farm Organically*

I WOULD like to give a typical example of how the organic method can be practiced on a farm, and can think of nothing better than taking our own 60 acre experimental farm located between Allentown and Emmaus, Pa., as an example. This farm is run by one man who, in special season such as haying, etc., is helped by our gardener. At rare times we get a third person to help, as a three man operation goes faster, in proportion.

We started to farm here about 1942, and for the first four years we did so merely by using compost made in large heaps using animal manure from a herd of steers we were fattening, plus three times as much green matter, consisting of leaves, weeds, spoiled hay, etc. The farm was terribly run down when we secured it and in addition, due to a shortage of skilled labor, we farmed with inexperienced help. So I cannot say too much about the first four years, except that we gradually noticed an improvement in the health of our family due to the increased quality of the food we ate, raised by the organic method.

By about 1945 or 1946 we began to make our compost in large pits and its quality improved, especially since we began to place large numbers of earthworms we were breeding into it. We also began to use raw ground phosphate rock. By 1947 we were able to secure the services of an excellent farmer and our yields began to go up. Today our average yields are from twenty to 40% higher than the averages for this area. In 1949 we found a quarryman near our farm who had a granite rock that he was grinding into a grit for chickens. It contained about 4% potash as well as many trace minerals. We convinced him to make some of this available as a fertilizer and he is now selling it as such. We applied some to our fields in the fall of 1949. Its formula is as follows:

| | |
|---|---|
| Potash | 4% |
| Phosphoric Acid | 10% |
| Copper | Very slight trace |
| Lead | Very slight trace |
| Iron | High |
| Aluminum | High |
| Nickel | Slight trace |
| Manganese | Slight trace |
| Silicon | High |
| Magnesium | Trace |
| Calcium | Trace |
| Sodium | Minor |
| Potassium | Minor |
| Vanadium | Slight Trace |
| Titanium | Trace |
| Gallium | Trace |
| Zirconium | Slight Trace |
| Strontium | Slight Trace |
| Barium | Slight Trace |

These rock fertilizers, the phosphate rock and the granite rock, are not chemical fertilizers in the sense that they are not mixed with acids and are not in too concentrated a form.

### The New Method

In the fall of 1949 came the revolution. We stopped making compost. Instead of that we are scheming out ways to take the same ingredients that we would use in making compost and put them directly into the fields. This not only will be far less labor but there will not be so much loss in liquid or solid portions of the material. Our only regret is that we did not think of making the change in the early summer instead of autumn, as you will soon see.

In the new method, the problem will be to find places where no active crop is growing so that the organic matter is applied there, where it could lie for three to six months to decay. It is not advisable to plant right after raw organic matter is applied to a soil, except where the soil is extremely fertile and rich with nitrogen. For example we are getting free corn cobs from a mill. In early July when our wheat and barley is off the land we could have immediately put down a layer of these corn cobs and by next spring when corn or oats are to be planted the stuff would be well decayed. Of course we grind these cobs first in an ensilage cutter, because the smaller the piece, the quicker it will decay. If barley is taken off in early July and it is desired to plant a fall crop on that field, like wheat, then perhaps the corn cobs should be ground a second time to make it finer, so that by the fall, there would be no danger in planting. One might experiment in applying a broadcast of finely ground organic matter over a growing wheat or barley or other crop in the late fall, where the land is fertile. In such case I would rather use ground up alfalfa or other

hay, so that the particles would be finer.

### Our Plan

What we actually did in this 1949 fall season was as follows: Where we are going to plant corn in May we put down a heavy layer of ground up corn cobs and ground up leaves and old hay, along with a lime, phosphate rock, and granite (potash) rock treatment. We also included some manure first, to lie under the green matter. Part of this will become well decayed by spring, but the upper portion will be sufficiently softened so that when it is disced in in the spring, perhaps a month before the crop is planted, it will not take long to decay.

We have also applied similar layers of material where the oats and soybeans will grow in the spring.

We have an old Chevrolet dump truck which we find is a wonderful investment. When the mill calls up that they have a load of cobs, we go for it at once. Formerly they burned it up, for no farmers wanted it and yet it has been found that the cob contains at least two thirds as much nutriments as the corn kernel itself. You might say, what would we do if a lot of other farmers were educated to compete for these free cobs? There are plenty of other organic residue materials that are now wasted. We sell a booklet called *The Manual of Organic Materials* (50c) which is chock full of ideas on this subject. Cider mills give away apple pomace. Egg hatcheries have the egg-shells which are full of animal egg matter. There is city garbage that can be composted by new fast processes, being accelerated by cultures of bacteria. There are large amounts of brewery wastes, cannery wastes, cotton gin wastes in the south, leather dusts, felt wastes, city leaves, sea weed, peanut shells, sawdust, and wastes from many industrial processes, pruning wastes, weeds from the wayside, etc.

### Free Material

We are now (January) in the process of hauling tons and tons of leaves from city dumps. All over the country there are hidden caches of such materials, which have been piling up for years, because a chemically-minded agriculture has not put any value on it and it has a cash value. I feel that a ton of leaves is worth easily $15.00 to a farmer based on what it contains, yet it may be had free for the hauling. Its value is seven or eight dollars for its nutrients and seven or eight dollars per ton for its organic matter content. In the fall season when the farmer has the time, what better way can he spend it than by hauling leaves? Thus far we have brought in over 100 tons of them. They are extremely rich in trace mineral elements for the roots of a tree go deep and bring up the minerals from inexhausted levels. This to us represents $15.00 value, yet in labor and gasoline it has not cost one-tenth of that amount. We smash these leaves up in our ensilage cutter, and in that condition, any farmer who runs his hands through the moist, rich brown material is bound to realize what a gold mine it is.

I don't care if the farm consists of a thousand acres. These methods are still applicable because it is not necessary to spend money for chemical fertilizers. On such large farms the amounts spent for chemicals are so high that with part of it an organic matter commissary department could be created, the function of whose men would be to do nothing but secure organic matter. With a dump truck and the proper grinding and mixing equipment, how such a department would build up the organic matter content of their farm! They would scour the countryside and not an unwanted blade of grass would get beyond their vigilant eye. They would go to the nearest city and return always loaded down with the richest kinds of organic materials. This is a new concept in farming which has not had the attention of the agricultural colleges. Its possibilities are tremendous. And how such quantities of organic matter would give the soil the ability to drink in the rain water!

### Solubility of Rocks

Anyone can see that this is a good method, for the phosphate and the potash of the ground rocks will be sufficiently available for the plant's requirements. It has recently been proven in the case of phosphate rock that if ground fine enough a sufficient part of it is immediately available to the plant's food requirements, and the way phosphate rock is sold today it is in fine enough form to become soluble quickly. Why anyone would want to use superphosphate, the chemical fertilizer, with its dangerous quantity of sulphur is beyond me. And it costs so much more. As far as nitrogen is concerned a goodly supply of organic matter will multiply the azotobacter bacteria which will extract it from the air.

Now here is the general idea about the organic matter used in this method of farming. There is one method in which you do not worry about bringing in organic matter that originates outside of your farm. You grow green manure crops on your own farm for plowing under, and you use phosphate as well as potash in the ground rock form. With this method you will get good results, but if you want to attain spectacular yields and the highest nutritional qualities in your crops, you should add besides your green manure crops, the outside organic matter. Then your farm will become the envy of the countryside and consumers will fight for your product.

There are sources of organic matter that can be purchased, such as cocoa bean shell wastes, which contain about 3% nitrogen, 1% phosphorus and 2% potash. There is cottonseed meal, fish meal (when the price comes down to normal) castor pomace, etc.

For the large farm with its organic matter commissary, standard equipment in the future will be a large, silo-like digester in which all kinds of organic matter will be turned into compost in a few days time by means of cultures of bacteria that will hasten the process. This is coming as sure as God made little apples.

J. I. RODALE.

# Champions Grow Champions

## Wesley and Fred Champion's Organic Grove Is Free From Disease and Pests

### By HERBERT C. WHITE

DID you ever lie awake nights listening to the leaves dropping from your citrus trees? Did you ever face almost total defoliation of your grove — with the stark and gloomy prospect of total loss at harvest time? Did you ever own a dying orchard? If you have, you will know exactly how Wesley Champion, Redlands Citrus grower, felt back in 1944 with his ten acres of Navel and Valencia oranges.

Did you ever harvest a "bumper crop" of top-quality fruit? Did you ever walk off with a "blue ribbon" at the National Orange Show? Were your oranges ever judged the sweetest, the most aromatic, and the most flavorsome of any pack at the Show? If you ever have, you will know exactly how the Champion Brothers felt last March when their fruit won Second Award in the "Growers Sweepstakes," with their twenty-four boxes of Washington Navels!

After reading the story of John Volkert's Florida grove in the November *Organic Farmer*, I couldn't resist the temptation to give our readers the equally helpful and significant experience of my good Organiculturist friend, Wesley Champion, right here in our own rival state of California.

In his enlightening article, John Volkert refers to the "troubles some California growers are having." In calling our attention to the problems involved in "reset" trees, Friend Volkert passes lightly over the dark and ominous clouds that are gathering in ever-increasing blackness on the citrus horizon here in the Golden West. For in my humble opinion, if something is not done—and done quickly—to reverse the downward trend in soil fertility, the glittering gold that attracted our forefathers to this fabulous state just 100 years ago, will turn to ashes under our very feet. And that *could* include the "golden" harvest of oranges, lemons, and grapefruit that has made California with its "Sun-kist" fruits famous throughout the civilized world.

For years the soil scientists and chemists have sought in vain to halt this rapid decline in soil health. Formula after formula has been tried out in the soil and on the trees, with little, if any, permanent benefits to the trees or to the quality of of their products. The *sympton* has been treated, but the underlying, basic *cause* has not been determined or an adequate program to remedy the deficiencies adopted.

Referring to the "brazen pride" of science, Fairfield Osborn in his monumental work entitled, "Our Plundered Planet," declares that life is far too complex to be remade or operated by chemists. With the voice of authority Mr. Osborn affirms that the *health* of plants depends on the living network of bacteria, fungi and earthworms underground and the proper balance of birds and animals and insects aboveground. And the books of heaven only can reveal the slaughter and devastation we have made in both these important realms in the field of agriculture with our caustic chemical fertilizers and poison dusts and sprays.

In his new book, this man of science tells how "a host of degenerative diseases are increasing in modern man and domestic animals," and attributes this decline to soil degeneration; a condition that has resulted largely from faulty agricultural practices that have destroyed much, if not all, of the precious, all-important *life* in the soil, on which the *health* of the plant depends.

In the scathing words of a Jeremiah, Osborn cries out against the "extraordinary blind destructiveness of man." According to this article on modern orthodox Agriculture, "Man has become definitely more *destructive* than any of the elements. With increasing technical efficiency he commits racial suicide with increasing rapidity."

All these harsh words seem to be in perfect accord with the warning given fifty years ago by Robert H. Elliott, famous British Agronomist, when he said:

"It is the physical condition of the soil, its permeability to roots, its power of absorbing and radiating heat, and its power of absorbing and retaining moisture, that is of more importance than its chemical composition.

"It is most unfortunate that all our agricultural textbooks should have given undue importance to the subject of agricultural chemistry. It should be carefully kept in mind that this is only one branch, and by no means the most important, of the many-sided field of agriculture. It must always be remembered that a soil may be chemically rich, and yet in productive power be far inferior to one chemically poor.

"Farming as it is practiced now, is more often the act of destroying *natural fertility* than adding to it. It is therefore no wonder that the land becomes impoverished."

Shame on us! But let's get back to Wesley Champion, his brother Fred, and those ten acres of erstwhile run-down-and-almost-out orange trees. Two years have flown by since my first visit to the Champion grove, situated on the southern outskirts of the thriving little city of Redlands. It was a real thrill for me to find on this fruit farm, a decided effort to put into practice all the principles laid down by our honored leader, the late Sir Albert Howard. Here the preservation of soil life in the orchard, and the abandonment of every practice that might jeopardize the health and vitality of these beneficent workers was regarded of paramount importance.

What I saw here, was in distinct contrast to the "groping for light" experience of Frank Hinckley, with his "non -cultivation" method. (See *Organic Gardening*, June 1947, for my story on "Frank Hinckley—Rebel"). Hinckley had only reached what Leonard Wickenden calls, "the half-way house." But Wesley and his brother Fred decided from the very first to go "all the way." And may I say here, that with the possible exception of my friend Mads Moller, of Glendora, who is an ardent composter and mulcher, the Champion Brothers are the only citrus growers with whom I am acquainted who have taken this stand.

Here is Wesley Champion holding out a clump of big oranges from a tree that produced 13 boxes of Navels.

Dr. Koentopp of Santa Ana, and R. W. Dickenson of Anaheim have performed miracles in their own particular lines of research in the field of organic soil amendments—but the Champions are pioneers in an earnest and faithful effort to "follow the book", as Sir Albert Howard and J. I. Rodale have laid it down for us in their enlightening works—and thus *their efforts* become of deeper significance to all the rest of us who are composters and mulchers, than perhaps any of the others.

# Champions Grow Champions

*Continued*

### Historical Background

The ten-acre ranch had been acquired by Mr. and Mrs. Joseph Champion in 1911 as a small subsistence farm. In 1922 the two brothers, Wesley and Fred, took over. But for years all the work was contracted for and performed with little, if any, supervision. All the conventional methods of cultivation were practiced, together with a liberal use of commercial fertilizers. Of course, all this eventually brought with it the inevitable harvest of disease, (Wesley says there were twenty-seven of them) and a multitude of insect pests that Wesley didn't even *try* to count! A rigorous program of pest control, such as fumigation, spraying and dusting was followed all through these dark, uncertain years.

In 1938 Wesley returned to the old home base, and personally took charge of operations on the farm. He still followed the usual "orthodox" practices, but with the addition of steer manure (about five tons to the acre). In 1941 and 1942 the supply of steer manure was cut aff, and on the advice of a commercial fertilizer salesman, only synthetics were used.

Then things began to happen—strange things, terrifying things. In the early part of 1943 the trees were attacked by the red scale, which did a lot of damage even before it was detected. A program of fumigation was ordered, but two months slipped by before the Fumigating Company could get around to do the job. At last the pest was destroyed. But killing the pest did not restore *health* to the trees. In fact tremendous damage was done, for in the process of fumigation, many of the trees were partially killed along with the red scale; the leaves dropped off all the trees, and up to 30% of the wood was destroyed. The grove looked like the aftermath of a forest fire—not a very pretty sight to the owners!

The following fall a cover crop of black vetch and mustard was sown in the orchard, with the hope that the nitrogen-fixing legume would help restore a measure of life to the half-dead trees.

While the brothers were debating the "reason" for this disaster that had overtaken them, a copy of *Organic Gardening Magazine* fell into their hands. The whole philosophy of biological soil building sounded reasonable, so in harmony with the immutable laws of Nature that the boys wanted to learn more. Sir Albert Howard's "Agricultural Testament" was quickly added to the Champion library—and they were off to a good start.

### A Program of Biological Soil Building

Of this first milestone in their organic farming experience, Wesley Champion writes: "While waiting for the *Organic Gardening Magazine* each month, we found little to guide us on citrus culture at that time. During 1945 we experimented with and added compost and agricultural lime. During this period we gradually reduced the amount of synthetic fertilizer used, depending more and more on biological soil building.

"After the crop of vetch and mustard was matured, it was turned under by means of a light disking, and then a year after fumigation we pruned out all the dead wood in the trees. This was permitted to lie on the ground and was later broken up with the disk and also turned under with the cover crop. In the meantime we were making our compost in accordance with Sir Albert Howard's 'Indore Process'."

On its completion, Wesley applied this compost modestly in the irrigation furrows. A bale of alfalfa was added per tree, and these were lightly disced into the soil together with another application of lime.

These simple procedures, which were beneficial to the soil life— bacteria, fungi, and earthworms—were followed up by a second application in 1946, with only slight variations.

The upper branch from the Champion's grove contains fruit up to 3½ inches in diameter. In the lower left is two inch fruit from the adjoining grove.

Permanent furrows for irrigation were then put in. This completed the overall plan for the non-cultivation, compost and mulching method, which has been in vogue ever since.

With their faces toward the light, and their backs to the old Devil with his cycle of death, the Champion Brothers were soon to witness near-miracles in that semi-arid Redlands soil.

### The "New Look"

To the obvious delight of the owners, the old grove soon began to take on an entirely new and different appearance. The new leaves were much larger than the old foliage, and of the true navel tree shape. The leaves were also darker, with a shining waxy appearance. The terminals (new growth) were longer and more vigorous. The fruit was much more evenly distributed over

the trees, both inside and outside. And the size of the fruit was much more commercially acceptable. May I note here, that as I travel around I find that in hundreds of Southern California orange groves, the fruit is getting smaller and smaller each year. In some sections it is getting to be a real problem. Like the pear orchard I visited a few weeks ago in the famous Rogue River Valley in Oregon, the fruit is so small that the owner has made no effort to even pick the products of his orchard for years. The cause?—Malnutrition.

**Higher Quality Fruit**

"Along with the deeper color of the leaves," declared Wesley, "the color of the fruit was noticeably darker orange, as contrasted with the trees treated with synthetic commercial fertilizers." In fact, the brothers informed me that the packing house foreman could immediately distinguish the Champion fruit from that coming from orchards where inorganic chemical fertilizers were in vogue by observing the difference in color, and also by the aroma and added fragrance. It is a sad fact that the fruit coming from many California orchards must now receive artificial coloring in order to look like oranges.

**Freedom From Disease And Pests**

And, friends, not only was the fruit larger and of higher quality, but there was also a decided gain in the vitamin C content of the Organically-grown orange, particularly with regard to the Valencias. The most noteworthy result of the Organic Farming program, however, was seen in the ability of the trees to resist insect pests and all twenty-seven diseases that afflict the undernourished trees in other men's orchards.

Says Wesley Champion: "The trees and fruit in our grove are now comparatively free from both insect pests and disease. Of course, we would not infer from this that some pest will not appear one time or another, under adverse conditions."

As an example of the ability of his humus-fed trees to resist the ever-present aphis, Champion told this interesting story: "We have taken a branch from a tree in a neighboring grove, heavily infected with aphis, and inserted it among the branches of a tree growing on composted soil, allowing it to remain for several days, with the result that nothing happened to the leaves in the compost-treated tree. Apparently the aphis found little in the healthy, composted tree to attract them."

**Increased Production**

"How about your production records since you began composting and mulching?" I asked. "For after all, an Organic Farmer, like all the rest of us, has to make a living while carrying on these interesting experiments in 'Creative Medicine' ".

By way of reply, Wesley reminisced a bit. "For ten years prior to the compost treatment, the crops were so light that no props were ever needed in the grove. This year we have had to use from six to nine props under each tree to hold up the heavily-loaded branches."

Then Wesley conducted me on a brief tour through the orchard. I had never seen anything prettier in my life! Although in some sections, the ground was literally covered with trash, the trees with their large glossy leaves, and fruit laden branches were a never-to-be-forgotten sight. I was shown many trees with branches bending down under their load of liquid gold, which later on in the season actually yielded from twelve to fifteen boxes of top-quality oranges. At $6.00 a box (orchard pack), that isn't what one would call "a total loss."

**All These Things Shall Be Added Unto You**

"At first, in adopting the Organic methods in the grove," observed friend Champion, "our principal thought and objective was to combat disease and pests, and thus save the trees from further damage or injury; but in addition to these primary objectives we have been blessed in abundant measure with a greater production of superior quality fruit."

Again we are reminded of Frank Hinckley's basic philosophy of orcharding—one that we can all follow and profit by. It it this:

"If you will feed the worm, (life in the soil)
The worm will feed the tree, and
The tree will feed YOU!

And, friends, from my unsophisticated viewpoint, biological soil building works out that way everytime! And what a thrill must have come to those two Champion orange growers when at the great National Orange Show, their Organically-grown, poison-free fruit stacked up to the "Champion" name as they walked off with $150.00 prize money, plus the coveted blue ribbon!

Boards, paper sacks, dead branches and all sorts of litter help to make up the protecting mulch between trees in the Champion brothers ranch.

*Soil*

# Is Any Soil Really Poor?

## A Discovery Which Corroborates the Theory Of Organic Farming

**By J. SIDNEY CATES**

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THIS is another chapter in the story of our present-day theory —or lack of theory—about soil productivity. Vast as have been the studies on what makes one soil produce while another falters, we have yet to nail down all the factors. There still remains an elusive mystery. And I am setting forth in this article, as a case in point, the manner in which the dread root rot of cotton has been conquered. This long-threatening and in many cases devastating menace to cotton in the Southwest seems on the way out. Thereby lies one of the most fascinating tales in agriculture, one that seems to involve the ages-old mystery of what makes land productive.

As you doubtless know, this generation-old and constantly growing curse of the Southwest cotton industry has been the subject of the most profound and exhaustive study by many groups of agricultural scientists. Millions of dollars have been spent in a hunt for a remedy. And through the years the toll farmers have paid through no worth-while harvest coming to reward their summer's effort has run into hundreds of millions of dollars.

Little has been said about this new cure for root rot. Perhaps this is because the remedy, in its outward respects, is so very simple. But its powers for good are based on highly complex action in the soil that could well be overlooked. Thus the simple cure, a sort of home one, has been lying around waiting to be recognized all the time the root-rot curse has been on the rampage and under scientific scrutiny.

Let me hasten to name this remedy, and then I will sketch its fascinating background and attempt to project some of its implications.

The cure for root rot of cotton consists in nothing more than turning under leguminous organic matter in the fall or spring before the cotton crop is planted. A heavy dose of stable manure will effect the same end, though the latter is seldom available in sufficient volume to be a large factor under most root-rot infested cotton-farm conditions. But this leguminous-organic-matter treatment of cotton soils has long been known to be highly profitable, even when no root-rot is present.

It is only when we get into the method whereby the nitrogen-filled organic matter in the soil overcomes the dread root-rot fungus that the breadth and scope of the discovery stands out. It is not through the chemical action of this rotting material that the cure is brought about. *The answer lies in the fact that teeming bacteria in the soil, these bacteria no doubt embracing thousands of strains, take on renewed life under the stimulation of this, their seemingly pet food supply.* Some of these stimulated bacteria strains are dread enemies of the root-rot fungus. The bacteria not only destroy the fungus on contact, presumably like certain bacteria destroy our own body tissue, but the antipathy between these two organisms goes much further. In artificial-media cultures the root-rot fungus dies even on the approach of the enemy bacteria growth.

The discovery leading to its control comes from C. J. King, Superintendent of the U. S. Department of Agriculture field station at Sacaton, Arizona. King observed one summer in a section where alfalfa had been grown, and in another section where table manure had been added, that there was little or no root-rot damage, while alongside, to the very sharp margin of where these treatments had been given, the cotton crop was almost devastated by root rot.

It is common knowledge that stable manure, or leguminous organic matter, is good for growing plants. But why should these materials be harmful to a fungous pest of plants?

### Good Bugs Fight Bad

King finally made a shrewd guess as to what was happening. He guessed that the bacterial growth there in the soil contained in its many kinds some sort or sorts that were, under this stimulation of stable manure or leguminous matter, simply playing havoc with the dread root-rot curse. He related this guess with much enthusiasm to his

Washington Bureau Chief. King himself is not a bacteriologist. But he asked for a bacteriologist to work under him and try to isolate from the soil the particular bacterial strain that was chewing up the root rot.

King got his bacteriologist. They sent him out a rather inexperienced young man, John T. Tresley. Maybe that was lucky, for a better-trained older man would, I believe, have laughed at the whole concept, and would have dubbed the task of finding such a specific germ, and isolating it from the billions of other germs there in the soil, as utterly fantastic.

But in an amazingly short time Tresley found just what King set him to hunt for. It was a bug that would kill the root rot not only in artificial culture media, but also when poured on sick cotton plants growing in soil.

A number of years ago I told this part of the root-rot story to *Country Gentleman* readers. I put it forth as a new principle in agriculture, that of setting the good microscopic life in soils to fighting the bad. I hesitated at that time to go very far in putting forth the discovery by King and his co-worker as a panacea for root rot, because we had not yet found out that the good bacteria that would jump on root rot so ferociously were to be found in all cotton root-rot soils. And then, too, in most of the worst root-rot cotton regions, not only is stable manure a relatively scarce article, but leguminous crops were also devastated by the root-rot pests. When Dr. Charles Thom, head of soil bacteriology studies for the USDA, at a later date, did suggest to Texas the use of legumes in the fight, he was met with the protest that legumes would harbor the disease and only add to the trouble.

But today it seems to be a well established fact that these good germs are everywhere present, and only need to be fed by legumes that they may multiply into teeming armies capable of doing the control job. Winter annual legumes can be grown throughout most of the root-rot region. *Millilotus indica* and Huban sweet clover, fall planted, make their growth when the temperature is too low for the root fungus to be very active. Certain varieties of cowpeas are showing high root-rot resistance when summer grown, even in the worst root-rot areas.

But this new and successful root-rot control method—that of altering the soil microbiology by feeding it with decaying leguminous material—is far bigger that the mere announcing of the abatement of a curse to Southwest cotton, devastating as the curse has been. To my mind the findings point to the clearing up of a veritable miasma of confusion about this whole subject of so-called "soil fertility." I loathe that term as inadequate and confusing.

"Fertility" is a chemist-proffered term. The word "productivity" gives the realistic picture to the practical farmer. For years we have been twiddling over the proper proportion of N, P and K and more recently over so-called trace elements, while the understanding of the broad phases of the soil-productivity mystery is not only confused, and unknown, but grossly neglected.

We are still without an explanation of how a few of the colossal soil-building crops do their jobs. For more than a decade now we have had corps of experts running up and down the country and studying census statistics and living conditions for different areas, and labeling land as marginal or submarginal. If these same sociologist-economists would oftener take their question to any modern trained crop man, they would be told of a simple way to transform a great part of these so-called marginal lands into productive acres. And transforming land, so simply, is a much easier task than transferring people.

### Soil-Building Mystery

The transformation of poor land into rich land which the crop men have worked out ties in with the mass and quality of organic matter produced by these soil improvers. But I have never yet found a philosophical-minded agronomist who would venture to say he understood just how the soil improving crop had done its colossal job. The method of conquering cotton root rot, however, gives another clue.

The late M. A. Crosby, of the U. S. Department of Agriculture, reported years ago that one sweet-clover crop would boost an old cropped-down Corn Belt farm from a thirty-five bushel corn yield level, back to more than seventy bushels. Later, R. M. Salter, now head of the Bureau of Plant Industry at Washington, found several years ago when with the Ohio Experimental Station, that one crop of sweet clover planted on raw clay from which all top soil had been removed, transformed this clay into better than fifty-bushel oat-yielding land. Mooers, of Tennessee, found that corn on an old *sericea lespedeza* sod responded with a yield stepped up from a pretreatment normal of thirty bushels to a new outturn of between seventy and ninety bushels to the acre. The vast scope of the improvement in productivity in these Mooers experiments has apparently stunned the old "soil fertility" students into an avoidance of consideration of what has taken place. The Mooers facts simply do not fit into any old orthodox concept of "soil fertility."

Another line of observations seems also to tie in with the successful use of leguminous vegetable matter for the prevention of cotton root-rot damage. I am referring now to the beneficial effect of so-called trace elements used as fertilizers. We have assumed that these elements are minerals needed for plant nutrition. Now there develops strong evidence that, in many cases at least, trace elements affect plants merely through action on soil bacteria.

### Iodine A Factor

A recent experimenter found that alfalfa got a big growth kick from a small amount of iodine. Further

(*Continued on page* 43)

*Beekeeping*

U.S.D.A.

# Airborne Agriculturists

## The Bee, a Friend of the Farmer, Is Finding Life Difficult

**By FRANK W. BALL**

SOME years ago certain New Zealand citrus fruit growers decided that honey bees were causing their lemons to grow out of shape. They proposed to slaughter them in the interest of their fruit crops.

America could well have used the bees this misguided bloc of New Zealand orchardists talked of killing. So could they, for that matter. Clearly it was the lack of bees rather than the many that caused the fruit failure. Lack of pollination causes ill-shaped fruit, or none at all.

A critical shortage of our best pollinating agents exists in America. We are hundreds of millions of bees short—and they are getting fewer. Deforestation, clean cultivation, stream-lined fences, and the reckless use of insecticides have depleted our supply seriously. The bee pollenizes fifty of our agricultural crops for seed or fruit. It is the only insect we have ever been able to "domesticate." All others determine to "go it alone."

Fortunately, the bee is by far the best equipped physically and by habit to serve us. It is well that we can "cultivate" it. Its body is especially built to carry pollen, 100,000 grains at a time. And, unlike other insects, the bee sticks to one species of flower on any trip from the hive. This alone makes it worth millions of dollars more than other insects that pollenize promiscuously.

The chief work of the bee is pollination; the annual production of 200 million pounds of honey and four million pounds of beeswax are mere by-products. Cotton, oranges, lemons, apples, peaches, cherries, and watermelons are but a few of the crops dependng almost entirely upon the bee. Agriculture as a whole depends on the bee for 80 per cent of its pollination.

The United States Department of Agriculture says we have 4½ million colonies of hive bees. The Haskin Information Bureau gives the number of bee colonies, wild and hive, as

5,797,000. The same authority states that well populated colonies may have as many as 45,000 bees each, and gives the number of individual bees at 250 billion. With bees living but six to ten weeks in working months, naturally millions die daily; so anything like an accurate bee census is impossible. But we know that the balance between plant life and pollinating agents is badly tilted.

We have more farms in the United States than we have bee colonies.

### Pesticides Don't Distinguish Friend From Foe

The destruction of the American honey bee has come about so gradually that few have noticed it. With his trees in bloom, an eastern orchardist told his beekeeping neighbor, "Watch out for your bees, I'm gonna dust," as though his neighbor could chain up his bees as he would his dog. The dust floated to all neighboring plants and bee destruction was all but complete. Thus both the orchardist and the beekeeper lost heavily.

A midwestern fruit grower sprayed his trees while in full bloom killing many of his neighbor's bees. His neighbor had a difficult time the next year convincing him that it was detrimental to them both to spray his orchard at this time. And we still have a few farmers who don't know the difference—or don't care.

Clean farming and the growing of enormous acreages have increased the burden of the bee. Cotton fields in some sections have shown an increasingly rapid decrease in pollination. America furnishes one-half of the world's supply of cotton.

When the rail fence was replaced by the steel wire fence the nesting place of many millions of pollinating insects was destroyed.

Farmers in many sections have quit growing honey producing plants for one reason or another, and have decreased the bee supply in so doing. Two chief producers of honey are sweet clover and alfalfa. A blight has so affected alfalfa that many farmers find it profitable to sow another crop, usually soy beans. Root rot and the weevil have made sweet clover unprofitable in many places where it once grew abundantly. And crops not nearly so valuable to the bee are now growing in its stead. The soy bean, covering millions of acres once covered by alfalfa and sweet clover, is by no means a honey crop.

And there are the ordinary bee diseases such as American and European foulbrood, taking their annual toll.

In many sections, as in the California orange groves, it is necessary to have a colony of bees to each acre of fruit orchard. Other sections, such as New York apple orchards, may get by with one for each two acres. It depends a lot on the fruit and the climate. But it may be seen by comparing acreages to bee colonies that our bee shortage is enormous. Hundreds of orchardists and cotton growers have to rent bees at blossoming time to insure a crop.

### Minnesota Is Our Top Honey State

California, supposedly America's honey producing center, is surprisingly outranked by Minnesota. Texas, with an estimated 13,995,000 pounds, ranks third. California with her orange blossoms and voluminous flora, no doubt boasts the greatest number of flavors. For dominating honey plants give honey distinct flavors.

Texas has many types of honey plants, grape fruit, orange, mesquite, horsemint, cotton, alfalfa, sweet clover, Madrid clover, white clover, vetch, huajillo, cat's claw and white brush. The state's 311,000 (estimated) bee colonies run second to California. It is a peculiar fact, or is it, that Minnesota, a state where the bee's working hours are limited by the weather, produces the most honey, yet has fewer bees than the two states running second and third in honey production. (Figures furnished by F. L. Thomas, State Entomologist of Texas.)

Ranking far down the list in honey production, probably about 25th, with 2,225,000 pounds of honey annually, is Texas's neighboring state of Oklahoma. At this writing, Oklahoma uses more honey than it produces. Among Oklahoma crops depending largely upon the bee are alfalfa, cranberry, the clovers, squash, cotton, fiber, and the various fruits. Eastern Oklahoma, including the Tulsa region, has the greatest bee population in the state. Ardmore is a honey center. The honey crop of Oklahoma is bringing beekeepers a million and a half dollars annually. Colorado is another state that ranks high in honey production.

### Protection For The Bee

So all who eat have a stake in the future of the bee. It is not exclusively the problem of the farmer. But these two gentlemen would certainly do well to work together. For assuredly they are each dependent upon the other.

The government should grant subsidies to beekeepers whose business has become unprofitable because of bee slaughter or a glutted market. Promiscuous spraying or dusting by anyone anywhere should be regulated by law. Enough fencerows should be left to provide nesting places. Farmers should plant honey crops and stop deforestation. Sheep, eating plants off even with the ground and trampling the roots below the sod, constitute a bee menace.

In West Virginia, we take pride in our buckwheat as a honey crop. (It is not so in every state, however.) But when our West Virginia farmers quit growing buckwheat, they will see their fruit crops begin to suffer.

When such honey-producing crops as sweet clover and alfalfa have to be discontinued, a crop of honey producing plants should be sown in their place. A giant white clover lately introduced from Italy, known as Ladino clover, has been found largely to take the place of either sweet clover or alfalfa in honey producing or as a feed crop.

# Soils and Proteins

## *The Declining Protein Content of Wheat and Corn Is a Sign of Decreasing Soil Fertility*

**By DR. WM. A. ALBRECHT**

*Reprinted from The Land*

RAINDROPS of the same size and shape are falling today with the same impacts and foot-pounds of energy for work in breaking down soil granules as they always have. But the chemical composition and other properties within the soil are significantly altered. A major but unappreciated change has been the decrease in the stability of the soil granules or in the stability of the soil structure. Soils that once retained well their loamy condition and plow-turned forms all through the winter, and through many rains after tillage, are now soon beaten down by only a few of them. As a result, much of the subsequent rainwater runs off and does not enter into the soil. We do less fall plowing. Our soils must be spring plowed if they are to remain granular and well aerated as a good seedbed through a significant part of the crop season.

This decreasing stability of the soil's granular structure is only another way of saying that the incidence of a weakened, if not "sick", soil body should be taken as the major change in our soil and thereby the basic cause of the increase in erosion. Here is the big reason why water has not been going into our soil but running off. It has been increasingly destroying the means by which food is created and agriculture is maintained.

Acid soils, soils that are highly saturated with hydrogen which is not a plant nutrient and therefore desaturated of calcium, magnesium, and all the other nutrients, do not granulate readily. Nor do they grow the nitrogenous crops to give calcium-rich, nitrogenous humus in the soil that brings about the stable granulation. Soils deficient in fertility are of weakened soil body. They are subject to severe erosion because that fertility deficiency is the weakness or the sickness. When surface soils lose their fertility to become similar to subsoils in this respect, they, of necessity, erode as badly and as rapidly as subsoils.

Soils deficient in fertility fail to grow cover quickly, or cover dense enough to be a mechanical aid against runoff and erosion. Barren soils erode because they are not fertile enough to feed the crop we grow on them and to have extra fertility kept in the cycle of going into organic combination as weeds and out again through their decay. In other words, our soils cannot take the impact of the rainfall because their fertility has declined too far to permit a stable soil structure, to grow cover quickly enough for prevention of excessive runoff and erosion, and to add organic matter.

To emphasize the decline of fertility in our soils may seem to be a mistake with our memory still strong (a) of the 1947 wheat crop in Kansas, the largest in our history, and (b) of the increasing yields of corn as the result of the scientists' application of hybrid vigor to this feed grain of high fattening power. Nevertheless, it is a fact that while the bushels per acre of both wheat and corn have been going upward, the concentration of the protein within each of these grains has been going downward. Because of the recent persistent decline in the concentration of protein in the wheat, the War Food Administration lowered the percentage figure which had long been the protein required of this food grain. Even though the total wheat crop has been increasing as bulk, the "hard" or high protein wheat has been marching westward in the United States. The "soft" or low-protein, and therefore high-

starch, wheat has been following in its wake. In like manner, the corn which had a protein concentration ten years ago of nearly 9.5 per cent, has the average figure of 8.5 per cent today.

While our crops have been yielding bushels per acre bountifully, those bushels have consisted mainly of the photosynthetic product, starch. At the same time those crops have been synthesizing for us less and less of their biosynthetic food products, particularly proteins. The soil that has been eroding more and more because of its declining fertility is the same soil which, for the same reason, has been giving us less and less protein, the food constituent so basic to reproduction and growth of all forms of life. Implied, then, in our conservation of the soil, is our struggle for food protein in order that we may survive.

"Yes," you may say, "we shall grant that the high yields in terms of both bulk and quality of our grain crops and the better reproductive capacities of their seeds may demand fertile soils. But there is still extensive room for a grass agriculture with less soil tillage in place of so much grain agriculture with its intensive stirring of the soil." However, one needs to be reminded that grasses are natural in that part of the ecological pattern where moderate rainfalls in the temperate zones have not weathered the rocks into the highly leached or nutrient deficient soils. They are growing on fertility laden soils.

Grasses are therefore feeds that are mineral-rich, and protein-rich. They are "grow" feeds rather than only fattening feeds for the herbivorous animals. They are therefore not to be juggled about from location to location merely as mechanical soil cover against erosion. They were native to soils of low rainfall or where cover was not the major part of their service in the great pattern. They were growing on soils granulated so deeply and so well as to take water readily to great depths. If the grasses are moved merely to give cover services in regions of high rainfalls, of leached soils, and of once-forested but now cleared areas, they cannot be protein producers for buffalo or beef cattle as we think of these in their prairie habitat. They may be soil cover, but are they capable of more than the photosynthetic performance of making wood by which their vegetative predecessors, the forests, are characterized?

Grasses may well be considered as soil cover in our efforts for soil conservation, but when so used in soils naturally leached or exhausted of fertility by cropping, we must ask whether they can be feed for the animals by which this form of verdure must become an aid for human survival.

It was the virgin grasses that indicated the high level of fertility in the prairie soils. It was the reserve of both organic and inorganic fertility there which served to grow the crops and livestock in the mid-continent and gave us our American prosperity. While we have been prone to speak of the prairie soils and their grass in the ecological pattern as though the grass controlled the soil and its high fertility, we have failed to appreciate the great fact that the fertility of the so-called "prairie" soil conforms to the climatic pattern of the development of the soil.

Our prairies represent the maximum of soil construction from the rocks by the climatic forces of rainfall and temperature, and also the minimum of destruction in terms of the capacity of those soils for growing protein-rich and mineral-rich foods and feeds for man and other higher animals. It was the prairie soils which, in their virgin conditions, were producing the bi-

**This wheat crop on the Organic Experimental Farm contained 10% more protein than chemically fertilized wheat from nearby.**

# Soils and Proteins

*Continued*

son, the large, well muscled, heavily boned, and herbivorous animals in large numbers. Those same soils today are producing domestic animals not so widely different from the bison in feed requirements, particularly beef cattle. These cattle are more highly concentrated in those soil areas than they are farther west, or farther east, where the hogs and their fat-producing power predominate. It is the cattle that are appreciated as providers of protein for the provision of which nitrogenous and mineral-containing feeds are required and widely grown there. They are not so deficient there as to necessitate importing them as supplements, as in the case on the more highly weathered soils in the East and its exhausted soils, or to the West with its undeveloped and rocky ones.

### Rainfall Affects Protein Content

With the increasing rainfall in going across the United States from West to East, the maximum of protein production does not rest on the soils highly developed under high rainfall with maximum production of vegetative bulk. This food producing capacity rests on soils with a moderate degree of development under moderate amounts of rainfall in the temperate zone. These soils give production of less bulk as found in our mid-continental belt. In the less developed, highly calcareous soils to the west of this area and in the more highly developed, hydrogen-saturated soils to the east of it, the fertility fails to support our crops as effectively in synthesizing those combinations of the amino acids representing the complete proteins required for maximum of human and animal health. It is in this limited, mid-continental belt where the soil fertility combinations permit plants to carry on both photosynthetic and biosynthetic activities to produce both carbohydrates and proteins. This is in decided contrast to more highly developed soils of the East and South where carbohydrates are the main agricultural output.

It is the fertility pattern of the soil according to the climatic pattern that determines whether we have largely carbohydrates or whether we have also proteins, minerals, vitamins and all the other essentials of good nutrition for man and his animals. That same fertility pattern gives us the corresponding ecological pattern, or the distribution of all life. It carries deep-seated and powerful implications in the solution of our problems of soil conservation. In attempting to conserve the surface layer of the earth's crust one dare not disregard or run afoul of the climatic forces in control of the development of the soil. They are in control of the assembly lines of agricultural production and all creation originating in the soil minerals and soil organic matter. Either they supply us or they deny us the nutrients serving as the foundation of the entire biotic pyramid with man at the top.

Soil conservation is not the application, on a national scale, of any single practice. It is the use of many practices according to the conditions of the soil. In humid regions, for example, where shallow surface soils are underlain by infertile subsoils, erosion is cutting away the very basis of agriculture. It is inviting drought damage. But such damage is disaster, not because the plants are failing to find water, but rather because the roots are going into the subsoil to escape the desiccation of the shallow surface soil. They are making a transition from the source of both water and fertility to a source of water only.

Drought damage to Missouri corn in the summer of 1947 represented a shortage of fertility because of dried, shallow surface soils overlying infertile clay subsoils and not because of a shortage of water for this crop. These facts were demonstrated by the absence of drought damage on the experimental plots given enough extra surface soil to double the normal depth of the soil. There was likewise no drought damage to the corn crop where liberal applications of nitrogen and other fertilizers were put down into the subsoil a few inches below the surface soil by means of the subsoiler on a TNT plow.

Soil conservation in the humid area calls for attention to fertility and for building the shallow soils deeper in these nutritional respects. It demands improvements in both the physical and fertility conditions of the subsoil as well as topographic rearrangements. Conservation calls not only for prevention of erosion, but also for efforts in building up the soil in its fertility supply by building downward. Such soils call for conservation practices quite different than do the deeper soils of the semi-arid area in Western Kansas, for example, where once was the dust bowl and where last year those remnant soils produced the maximum wheat yields in the history of that state.

### Too Many Cash Crops Harm Soil

Soil conservation implies a need for reduction in the economic pressure on the soil. Reports by the Federal Land Bank on the management of farms obtained through foreclosures tell us that only those farms with the more fertile soils could be managed by the Bank without loss. As the soils were less fertile, the farms failed by larger amounts to be safe investments. If poor lands cannot pay for maintenance of their fertility, as is shown by these data, it is evident that the better lands are listed in a favorable economic classification because they have enough fertility to be mined to keep them under that category. Future generations are therefore already in jeopardy not only as concerns the economics of agriculture, but also as concerns food production for survival. Economic pressure,

(*Continued on page* 48)

# Powdered Rock Fertilizers

***By utilizing ground, raw rock, agriculture can unlock tons of natural minerals***

**By DR. W. R. RAYMOND**

THE importance of trace minerals for plant nutrition is being increasingly recognized by organiculturists. The researches of Dr. Albrecht of the Dept. of Soils of the University of Missouri have demonstrated quite clearly that unless the soil contains a sufficient quantity of the various trace elements—fluorine, manganese, etc.—the health of plants and the animal and human populations that feed on such plants will suffer. In an article, "Are We Starving to Death?" which appeared in the *Saturday Evening Post* a few years ago, Neil M. Clark referred to the work of Dr. Albrecht as follows: "An eminent soil doctor warns that, unless we attack the problem of mineral-depleted land on a national scale, we face slow extinction from 'hidden hunger'." "Hidden hunger," according to Dr. Albrecht, means slow starvation of plants, animals and human beings resulting from a deficiency of trace minerals in the soil. These minerals are required in only minute amounts, yet unless they are present in the soil on which our foods grow, we will, he says, literally starve to death no matter how much we eat. Otherwise we suffer characteristic deficiencies, manifesting in special diseases. Thus a lack of fluorine in the soil predisposes to tooth decay. A lack of iodine predisposes to thyroid trouble. A lack of copper or manganese, even if sufficient iron is present, may result in interference with hemoglobin formation and lead to anemia.

At an early stage in his research work devoted to the relation of the soil to human health, which parallels similar investigations at the Department of Agriculture's Plant, Soil and Nutrition Laboratory at Ithaca, N. Y., Dr. Albrecht came to the conclusion that Pasteur's germ theory does not explain the origin of many human ailments, nor can mere lack of specific vitamins account for these. In association with certain physiologists, physicians and dentists who were his friends and colleagues, Dr. Albrecht, as a soil chemist, attacked the problem of the origin of human disease from the soil angle. He started with the reasonable assumption that healthy, mineral-rich plants will provide healthy, mineral-rich food for animals and human beings, who, as a result, will be healthy, whereas unhealthy, mineral-deficient plants will lead to similar ill-health and mineral deficiency in organisms which feed on them. Now the health of plants depends on the soil on which they grow; and if they suffer mineral deficiency so must the soil. Dr. Albrecht found that sick animals and human beings will generally be found in regions possessing "sick" or mineral-depleted soil. This, he found, was the case in sections of the country suffering from excessive rainfall, where the soil has been robbed of minerals from leaching. This, he maintained, explains the poor health of both animals and humans in many parts of the southeastern states and in various tropical countries where rainfall is torrential. On the other hand, he found that dry regions, as parts of Texas, produce healthier, stronger animals than regions where soil minerals are leached by too abundant rains.

Since the health of animals and human beings fundamentally rests in the soil from which they derive their foods, Albrecht concluded that when they are sick, they must be best re-

stored to health by being fed on nutriment raised on healthy, mineral-rich soil. He concluded that it is first necessary to "doctor" the soil before we can hope to restore health to the creatures that subsist on it — whether plants, animals or humans. It was due to his preoccupation with the problem of restoring "sick" soils to health that Dr. Albrecht gained the title of the "soil doctor."

American soils, Dr. Albrecht found, are universally sick in spite of the fact that they have been farmed only for a few centuries. On the other hand, he noted that the soils of China, though farmed for over fifty centuries, still preserved their fertility and were healthy. Why this was so became clear to him when he compared how Chinese peasants and how American farmers feed their land. The former provide it with organic matter almost exclusively, which supplies not only humus to feed the bacterial and earthworm population, but also certain trace minerals that such organic matter contains. On the other hand, the American farmer depends on the use of chemical fertilizers, which supply no organic matter or trace minerals, and act to kill soil bacteria and earthworms. Obviously, conventional American methods of feeding the soil by the use of chemical fertilizers, Dr. Albrecht concluded, is the reason why American soils are sick and exhausted, why plants grown on such soils are attacked by disease and insect pests, and why animals and human beings living on such produce also suffer from disease and physical inferiority.

Dr. Albrecht's researches on trace minerals were paralleled by those of an Alabama physician who turned to the study of soil chemistry, Dr. Charles Northen. While Dr. Albrecht started with the soil, and showed how deficiency of trace minerals in the soil leads to diseases of plants, animals and human beings, Dr. Northen started with the problem of the origin of human disease, which he traced to mineral deficiency of the soil, resulting in a lowered mineral and vitamin content of our foods. How to restore these missing minerals to the soil, and so increase the mineral and vitamin content of foods was the problem he sought to solve. Early in his research he came to the conclusion that the chemist in his laboratory could never solve this problem, since he could never arrange exactly the right combination of minerals to duplicate the combination and proportions of minerals found in virgin soils, which were originally derived from disintegrated rocks. He therefore sought a *natural* source of trace minerals. He found it in colloidal phosphate, a prehistoric marine deposit mined in Florida, formed from the bony structures of prehistoric marine creatures, containing over twenty trace minerals originally derived from the sea, predominating in phosphorus and calcium compounds. Dr. Northen found that when colloidal phosphate is added to plants and trees made sick by a one-sided mineral-deficient diet of chemical fertilizers, they recovered. Likewise when such plants were attacked by insects and required spraying to protect them, addition of colloidal phosphate, supplying the trace minerals, caused insect infestation to cease. In one of his experiments, Dr. Northen grew two intertwined tomato plants in separate pots, one of which was given only chemical fertilizer, suffering a deficiency of trace minerals as a result, while the other was supplied with these trace minerals by use of colloidal phosphate. The tomato plant lacking trace minerals was infested with insects, while the inter-

—USDA

The deformed legs of this rabbit were caused by a magnesium deficient diet.

twined one fed with trace minerals was not!

Albrecht conducted a similar experiment and came to the same conclusion, *i.e.*, that deficiency of trace minerals is a cause of insect pests. He grew two rows of spinach in a medium which was completely devoid of trace minerals, adding trace minerals to one row, but not to the other. The row that lacked the trace minerals was attacked by a little bug, the thrip, while the other plants, fed on a mineral-rich diet, were not. Both Albrecht and Northen, on the basis of their experiments, conclude that deficiency of trace minerals in the soil is a cause both of plant diseases and insect pests. In some of his experiments Albrecht showed that the health and vitality of a plant varied directly with the calcium content of its nutriment. What is true of calcium is also true of the other minerals plants are known to require, most of which are not supplied by chemical fertilizers.

**Trace Minerals May Prevent Diseases**

In "The Merck Report" for July, 1949, an interesting article appeared written by Dr. Albrecht in cooperation with F. E. Pottenger, M.D., and Ira Allison, M.D., relating to the effect of ingestion of trace minerals on human diseases. On the basis of a study involving the feeding of 1,800 patients with supplementary diets containing an abundance of trace minerals, including manganese, copper, cobalt, magnesium and zinc, the results obtained were so spectacular that these investigators came to the conclusion that deficiency of these trace minerals may be the cause of multiple diseases now considered of bacterial origin, including undulant and Malta fevers, to which the report was especially devoted. In fact the number of diseases which these investigators considered to be caused by deficiency of trace minerals and overcome by supplying these trace minerals was, in their opinion, quite considerable—"possibly as large as two hundred." The following are among the symptoms which they found to be due to lack of trace minerals, since diets containing such minerals were found to relieve them: fevers, constipations, enlarged spleen, mental depressions, arthritis and backaches.

Summing up, the authors conclude that "varied nutritional deficiencies, including trace minerals, may be the common cause of multiple symptoms, including the presence of these particular microbes (which, in this case, cause brucellosis)." This was shown by the fact that ingestion of foods containing trace minerals led to a prompt recovery. Their studies indicate that trace minerals, and not bacterial agents, are the determining factors in the causation of a large number of diseases whose cause is obscure. Harmful bacteria commence to thrive, and corresponding disease symptoms start to appear, only when there is a marked deficiency of trace minerals, which deficiency provides the underlying cause of many diseases — in animals and human beings as well as in plants. It may be assumed that either trace minerals act as toxins to harmful microbes or that friendly, protective ones require trace minerals for their propagation and effectiveness, which seems more probable. These investigations are bound to revolutionize our conception of the origin and nature of disease. More fundamental than the bacteriological realm is the minerological one. When the minerals of life exist in a proper balance, the organism is healthy and resistant to disease germs, whereas when mineral metabolism is disorganized—either through lack of essential minerals or due to the action of chemical poisons derived from fertilizers and spray residues in the foods consumed (in the case of "civilized" animals and humans)—disease and the accompanying propagation of so-called "disease germs" manifest. Will Dr. Albrecht's discoveries concerning trace minerals replace Pasteur's germ theory as the basis of the pathology of the future?

**Vitamins and Rare Minerals Are Related**

Both Northen and Albrecht found that there is a direct relation between the quantity of trace minerals in the soil and the vitamin content of foods raised on such soil. In fact, one might be led to ask whether many of the so-called vitamins were not really the result of the assimilation of specific trace minerals by plants. By addition of a small amount of manganese to a field growing tomatoes, a certain food processor increased the vitamin C content of the tomatoes threefold. A the correspondence is so exact that similar increase of the vitamin A content of apples was brought about by application of boron around the apple trees, in this case the increase being 100%.

In Nicholasville, Kentucky, a retired scientist, Albert Carter Savage, has established a "mineralized garden" in which for many years he grew "mineralized vegetables" that were raised on soil enriched with colloidal phosphate and powdered rocks, in addition to other substances. A number of sick people came to his farm and were fed on his vegetables containing an abundance of trace minerals. Remarkable cures were reported, some nearly miraculous. Carter wrote a book, "Mineralization: A New Basis for Proper Nutrition", in which he stressed the importance of trace minerals in our diet for health. While he recommends the use of colloidal phosphate and powdered rocks as a source of trace minerals, he commits the blunder of using also chemical salts. With this the writer does not agree.

**Chemical Salts Can Be Toxic**

Most of the experiments on trace minerals have been conducted by supplying these minerals, in small amounts, in the form of chemical salts. That this is not the best method of supplying these trace minerals to plants is shown by the fact that when such salts are supplied too freely, toxic effects soon manifest

# Powdered Rock Fertilizers

*Continued*

themselves. They are much like drugs which, when fed in small, homeopathic doses, produce no apparent ill effects, which they often do when given in liberal, allopathic amounts. Speaking of this subject, the writer recalls a visit once made to Prof. Shive of Rutgers University, one of the leading authorities on "sand culture", a form of chemiculture similar to hydroponics. The professor gave him a tomato he grew in sand by the aid of a nutrient solution of chemicals, which appeared much like a normal tomato. But its appearance was deceiving, as its taste was simply horrible — resembling more the taste of the chemicals used in its culture than that of a real tomato. As we have shown elsewhere, trace minerals are best supplied not in the form of isolated chemical salts, but in a natural manner as supplied by powdered rocks and colloidal phosphate.

Granite quarries, like this one, are capable of producing a trace element rich ground rock fertilizer.

**Hensel Originated Rock Fertilizer, a Source Of Trace Elements**

A forgotten genius who is regarded by many as a forerunner of the modern organicultural movement lived in Germany during the last century. His name was Dr. Julius Hensel, one of the most well known German agricultural chemists of the latter nineteenth century. Though Hensel did not recommend the use of animal manure, which was in line with his general vegetarian philosophy, he nevertheless was a real pioneer of the present organic movement, since he was the first to raise his voice emphatically against the use of chemical fertilizers and sprays. However, Hensel found a powerful enemy—the German chemical trust—which succeeded both in putting his powdered rock fertilizer ("Stone Meal") off the market, by selling their chemical fertilizers at a lower price, and in suppressing further publication and distribution of his books, which have since become almost entirely unavailable to the reading public. In fact the teachings of Hensel were lost to the world until, in 1924, an American farmer, Jack Gaerity, published privately a small booklet, "Bread and Roses From Stones", which, two decades later, Rodale made known to the world at large in his book, "Pay Dirt". However, in another way, Hensel influenced modern organiculture and may be regarded as its pioneer, for some years after his passing, German followers of Dr. Rudolf Steiner, a teacher of philosophy and agricultural reform, took up some of his teachings, especially his recommendation of the use of powdered rocks in place of chemical fertilizers and his condemnation of the use of poisonous sprays. They combined powdered rock fertilization with the compost method, using special activators to activate their composts . This method of soil culture became the basis of the so-called "bio-dynamic" method of farming. In 1930, the writer had the opportunity to attend a convention of about a thousand "bio-dynamic" gardeners held in Berlin, at which their agricultural products were on exhibition. At that time, "bio-dynamic" farms were established all over Germany, growing vegetables, fruits and grains by the organic method and shipping their produce directly to consumers demanding such in place of ordinary chemically fertilized, sprayed vegetables and fruits. A few years later, Rodale started Organic Gardening in America.

Julius Hensel was originally a miller. One day, while milling some grain for a customer, he noticed that some small stones mixed with the grain were reduced to a fine powder. This gave him an idea. Why not make a "stone meal" in the same way as one makes a meal out of grain, and why not put it on the vegetable garden and see what happens? Hensel at once acted on this idea, and went gathering up stones, which he reduced to a fine dust. He applied this stone dust over his garden, and was surprised at the luxuriant growth of his vegetables that followed. He was especially struck by the fact that these vegetables were immune to infestation by insects, to which they otherwise were subject. And when he ate them, he found that they had a much superior flavor

than they ever had before. Since he was born with a constitutionally weak body, and a vegetarian because he found such a diet easiest for him to handle, Hensel decided to fertilize all his vegetables by use of stone dust, and he found that his health greatly improved after he did so. So enthusiastic did he become about this accidental discovery that he decided to put on the market a powdered rock fertilizer known as "Hensel's Stone Meal", which enjoyed popularity in Germany during the last decade of the nineteenth century, until it was suppressed by competitors and replaced by their chemical fertilizers.

Hensel then tried his "Stone Meal" (really a mixture of powdered rocks, including granite, gneiss, porphyry and limestone) in fruit orchards. Fruits that were formerly wormy were found to become free from worms. Also their flavor and productivity increased.

Hensel then wrote a book, "Bread From Stones: A New and Rational System of Land Fertilization and Physical Regeneration," which in 1894 was published in the English translation by A. J. Tafel in Philadelphia, and provided the basis of Gaerity's booklet referred to above. In this book he presented his basic theory of agriculture by use of powdered rocks, considering the subject from a viewpoint of the agricultural chemist. His theory was that all soil minerals were originally derived from the decomposition of primitive rocks, and that by applying a fine powder obtained by grinding primitive rocks, as granite, to the soil, all the various minerals that were since removed by growing crops or leached by rainfall may be restored in a natural manner, and in a much better way than by the use of isolated chemicals which compose chemical fertilizers. Hensel was the first to stress the importance of the trace minerals both for the health of plants, and of animals and human beings which subsist on such plants; and he maintained that the natural and best way to obtain these trace minerals was by the use of powdered native rock as a natural fertilizer.

Many gardeners, florists and farmers in Germany tested Hensel's theory, and all were enthusiastic about the wonderful results they obtained by the use of his "Stone Meal" in their gardens and orchards. One of these was a medical man, Herm. Fischer, M. D., of Westend, Charlottenburg, Germany, who, in the *Pomologische Monatshefte,* edited by Friedrich Lucas, director of the Pomological Institute in Reutlingen, in 1892, wrote an article on Hensel's work, in which he said:

"Not only those who like to eat fruit and vegetables, but much more those who raise fruits and vegetables rejoice in the abundant and savory produce of our gardens. To maintain this produce and, if possible, to increase it is the endeavor of rational horticulture. This end is striven for through careful cultivation, and more especially by abundant manuring, especially with nitrogenous compounds. I say this end is striven for, but it is not always reached. The long-continued labors of a well-known investigator, Julius Hensel, have opened new prospects for agriculture, fruit raising and horticulture. They show, in fact, how we can 'turn stones into bread'. Hensel's book, 'Das Leben', has lately appeared in a second edition. Every thinking reader will find a high enjoyment in the study of this book. For our special consideration I recommend especially Chapter XXX, p. 476, 'Agriculture and Forestry.' Lately a little work, by the same author, has appeared on 'Mineral Manure the Natural Way for Solving the Social Question', published by the author at Hermsdorf unterm Kynast, Silesia. The first part of the pamphlet is devoted to the defensive, for like all pioneers our author meets with violent opposition from the orthodox teachers of agriculture, whose cues and periwigs have come into a great state of agitation.

This pulverized granite fertilizer has remedied trace element deficiencies naturally and at low cost.

"After his defense, the author passes to his theme proper. Earth, air, water and sunlight must cooperate to produce a fruitful growth. We entrust our seeds to the earth. What is 'earth'? The earth or soil is disintegrated primitive rock (gneiss, granite, porphyry). The soil of our fields is continually being increased by the disintegration of primitive rocks, and from this there grow up grasses, herbs, shrubs and trees. Without mineral constituents, no

# Powdered Rock Fertilizers

*Continued*

plant can grow. Now, when in level plains the upper layer of the soil, through long cultivation, has become exhausted of certain necessary mineral constituents, new rocky material must be provided from which nothing has as yet been grown, which, therefore, still contains all its strength. This is not only the most natural, but also the cheapest way to increase and maintain the yield of our fields. This is not mere theory, thought out in the study, but experience and success have demonstrated it. With Hensel there is no more need for experiments but merely of demonstration. A firm in the Rhenish Palatinate has produced a variety of fertilizers according to his directions, out of pulverized rocks, such as are most suitable for the various plants. I will here only mention fertilizers for vineyards, meadows and potato fields. Hundreds of advocates affirm the favorable results of these fertilizers. The rest should be read in the pamphlet itself.

"Since the spring of 1890, I have used stone-meal manure in my garden, situated on our well-known sandy soil, and am extraordinarily well pleased with the result. I have picked from a row of raspberry bushes about twenty-three yards long, fifty quarts of the most delicious fruit, some of over one inch in length and three-fourths of an inch in diameter. The shoots of this year, which will bear next year, are as thick as a finger, some as thick as a thumb, and up to eight feet high. The young fruit trees planted about three years ago are bearing very well, and what is well to notice, they are set abundantly with buds for blossoming next year. What is especially surprising is that I have no worms at all, neither in my raspberries nor my early pears and apples. The winter apples also have so far not shown a single worm-eaten fruit.

"My vegetables I sowed in furrows, covering first with mineral manure and leveling the furrow with earth. The plants I took out to transplant have such a mass of roots such as I have never seen even in a manure bed. They, therefore, were easily transplanted; none withered."

Dr. Fischer then goes on to tell about the marvelous vegetables he grew by the aid of Hensel's "Rock Meal" alone, and concludes that, in addition to all these advantages, powdered rock fertilizers are cheaper than chemical fertilizers. He concludes his discussion by quoting the following statement by Hensel: "We need no artificial manure if we supply that which we annually draw from the soil in the form of fruits, etc., by means of fresh, unexhausted pulverized granite, gneiss or porphyry as the genuine strengthening and primitive fertilizer." (To this Hensel recommends addition of limestone—the combination constituting what he calls "Rock Meal".)

### Hensel is Recognized As Ground Rock Pioneer

A number of other German physicians were attracted to the teachings of Hensel. One of these, Dr. Emil Schlegel, a physician in Tubingen, published an article in the *Wegweiser zur Gesundheit,* on Sept. 15, 1891, in which he says: "The chemist, Julius Hensel, of whom we have several times before this spoken in earlier numbers of the *Wegweiser,* and who is known to its readers by his genial book *Das Leben,* has lately published another work which deserves particular mention. . . . The true cure of an exhausted soil consists, according to Hensel, in supplying it with comminuted rocks, especially granite, gneiss, porphyry and lime. Thereby the plants receive again what they naturally demand. The *Wegweiser* would here remark that the test proof of these views given on a great scale is thousands of years old, i. e., the fertility of Egypt. The mud of the Nile consists almost exclusively of finely comminuted rocks, with very, very few organic nitrogenous constituents. But the flooded districts owe their unexampled fertility to just this precipitated stone dust. Hensel writes at the end of his book:

"'Almost every field contains stones which have only been acted upon in part by the dissolving moisture of the soil, and which therefore show a more or less rounded form. These stones, as they injure the spade or plow, are usually removed to the sides of the fields and there heaped up, and are then sold at a cheap rate for use on the highways. The farmer who acts thus sells his birthright, so to say, for less than a pottage of lentils, for he removes a source of fertility from his fields. If such stones are heated in the stove or on the hearth for half an hour and then thrown into water they become so friable that they may be broken into small pieces by the hands and may easily be pulverized with a hammer.' It is to be wished that these developments of Hensel should find a wide diffusion."

We thus see that decades before Dr. Albrecht commenced his researches on trace minerals, Hensel in Germany empirically demonstrated their importance in agriculture, putting Dr. Albrecht's theories into practice long before Albrecht even formulated them. He showed that powdered rocks are undoubtedly the best natural source of trace minerals, and certainly far better than the use of chemicals. For no chemist can equal Nature in her master creation of compounding various minerals to form the rocks from which soils are formed, and from which plants, animals and humans ultimately derive the minerals on which their lives depend. All we can do is to reproduce Nature's process of disintegrating rocks to provide minerals to soils, which took millions of years to accomplish, which may be done in a short time by fertilizing our lands with powdered rocks. In this way all soils may be remineralized and supplied with trace minerals without the need of chemical fertilizers or chemical "plant foods."

*Dr. Pfeiffer Continues His Discussion Of Soil and Soil Testing*

# Plants as Indicators of Soil Reaction

## By DR. E. E. PFEIFFER

ONE of the great differences the organic farmer will observe almost at once, when changing from other methods to organic management, is the decrease in acidity. This drop was one of the most striking changes which the author observed on his own dairy farm. The farm was a medium heavy, stony, clay soil. A five-year rotation is followed: corn, winter wheat plus clover, 2 years of clover, soybeans. When organic management was begun in 1944, the average acidity of 21 fields was around pH 5.5 to 5.8. Now in 1949 it is pH 6.5. And this result has been obtained with a minimum of lime, on most fields not exceeding 1 ton/acre once in 5 years.

A thorough surface cultivation, subsoiling and drainage are essential factors in the decrease of acidity, as well as the use of composted manure rather than fresh manure. A well treated and well rotted humus compost has a reaction ranging from pH 7.5 to pH 8.0 and acts as the best "alkalizer" of an acid soil without the harmful effects of over-liming. One ton of lime per acre may be given at first as a kind of starter, but the organic farmer will soon see that he needs less and less lime.

The acidity requirements of crops vary widely. In soil testing, acidity is expressed in pH. 7.0 is neutral, 6.0-6.8 is considered slightly acid, 5.5-6.0 acid, 5.0-5.5 very acid. Below 5.0, very few crops if any will succeed. 7.2-7.5 is slightly alkaline, 8.0 alkaline, and again a limit to successful plant growth is set at this level.

As regards humus, the acidity expresses the presence of acid humus; similar to peat between 4.5 and 5.0; acid, raw humus from 5.0 to 6.0. The acid, raw humus, as it is normally in marshes and woods, contains many fungi, but few aerobic bacteria, and is hostile to nitrate fixation. It is, therefore, usually low in nitrates. The most fertile and "holding" humus, with all possible "hidden" reserves, exists between pH 6.2 and 7.2. Here the highest amount of fixed, nitrate nitrogen and the greatest aerobic bacteria activity are possible. Within these limits the nitrogen fixing bacteria do their best work. In strongly alkaline soils, the humus gets hard, crusted and "dead". Then too, a large part of the good humus can be washed out and run away in alkaline soils.

A soil test, therefore, should compare the total organic matter content, which contains everything (i. e. humus, bacteria bodies, plant roots and residual particles, digested and raw organic matter), with the acidity. On the basis of the above-mentioned data, the experienced reader will then be able to judge how much acid, raw or neutral, colloidal humus is apt to be present. Our laboratory is just now developing methods of testing for acid, raw and digested, neutral humus. This classification will play an important part in future organic soil judging and research.

There are other things which are frequently determined by the soil reaction. The effectiveness of phosphates, for example, is very much limited by the lime content and acidity of a soil, preferring a pH of 6.2. Potassium, however, is less particular and is easily available anywhere from 5.0 to 7.0. Fungi and mycorrhiza prefer a moderate acidity, while nitrogen producing bacteria do not work below 6.0. Most of the beneficial soil bacteria live between pH 6.0 and 7.2. Then there are certain crops which are subject to fungus infections at neutral or alkaline reactions. In order to protect potatoes against scab and tobacco against root rot, an acid reaction of 5.5 is required. While pH 6.0 might produce the greatest volume in these cases, 5.5 will result in the healthiest growth.

### Acid Soil Plants

On the background of what has been presented so far, we shall now look at various crops and plants grouped according to their pH requirements.

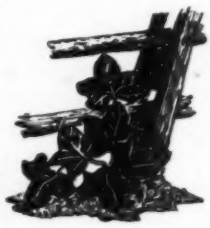
Acid loving crops are (range 5.5 to 6): Lima beans, carrots, blue lupines (as a green manure crop on

# Plants Indicate Soil Reaction

*Continued*

sandy soils), buckwheat (which alkalizes a soil), certain varieties of onions, strawberries, wild ones in particular; a few, which have been developed in Florida and Texas, can stand a neutral to slightly alkaline soil.

The following weeds, grasses, flowers, berries, shrubs and trees prefer and are even indicators of an acid soil between 5.0 and 6.0 (unless otherwise remarked): Amaryllis, arnica (4.0-5.0), trailing arbutus (4.0-5.0), arbutus or strawberry tree (5-6.0), most of the asters, azalea, bent grass (5.5-6.5), birch, bluebells, blueberries, bracken, Scotch broom, wild calla (4-5), camellia (4-5.5), Carolina jessamine or yellow jasmine, the American chestnut, wineleaf cinquefoil (4-5)—when this weed appears on pastures it is high time to do something, plow them up, check on the drainage, aeration.



Others among those eager for soils with an acid reaction are: the curly clematis, club moss, the hairy, rose, threadleaf and trefoil coreopsis, cranberry (4-5) cypress (Chamaecyparis), swamp dewberry, Easter Bell, Feather Fleece-Stenanthium robustrum, a fern, Upland Lady, Massachusetts, Hay-scented, Narrow-leaved Chain; bulbous plant (4-5), some of the the firs, Venus's-fly-trap, many of the terrestrial orchids, the White Fringe Tree, Gayfeather or Button Snakeroot, Sweet and White Goldenrod, Grapeferns (Botrychium, not true ferns but allied), the greenbriers, hardhack, heath (Erica), heather (calluna vulgaris), the common and the Carolina hemlock, American holly, huckleberry, hydrangeas with blue blossoms (those with pink blossoms grow on near neutral soils), most iris, creeping juniper, Lambkill, most of the wild lilies, Sun-dial and yellow lupines, most of the magnolias, Mountain and striped maple, red milkweed (4-5), Mountain-dandelion, Mountain-laurel, Blackjack and Sand oak, Scrub oak, Southern red oak, brook parnassia (one of the saxifrages), peanut, creeping, mountain and sandhill phlox, many of the pines, Pitcherplant (4-5), Fringed Milkwort, common Prickly-pear, European raspberry, most of the plaintains, rhododendron, rhodora, Greenland sandwort, Fraser sedge, American Storax, Spike, Speedwell, Appalachian and lobed Spleenwort, spruce, American Starflower (4-5), English Stonecrop (a sedum), Stonemint, Sundew (4-5), Sweetbay (4-5), Sweetfern, Turtle-head, American Twinflower, Birdsfoot Violet, white cedar, yellow wild indigo, creeping willow, wintergreen, Smooth Witherod (Viburnum nudum), some of the woodferns, common woodsorrel, Yellowroot.

It would certainly seem to be a fruitful project to study the weeds, wildflowers, trees and shrubs in your surroundings. These tell you better and quicker than any soil testing where you stand.

### Sweet Soil Plants

Since most of the wild and cultivated plants not listed above grow best between pH 6 and 7, we will only present those which can stand a slightly alkaline soil too, i. e. from 6 to 8: Abelia, acacia, alder, almond, alyssum, ampelopsis, amaranth, American plum, anemone, apples, arborvitae (Thuja), ash, some of the garden asters, common bald cypress, barberry, beach plum, beech, sugar beet, begonias, bellflower (Campanula), bitter nightshade, bittersweet, blackberry, bloodroot (Sanguinaria canadensis), Virginia bluebells, Kentucky bluegrass, common box, broom grass, buckeye, buckthorn, Lespedeza, buttercup (another danger signal on pastures, for it inhibits the growth of clover), buttonbush, calendula, cantaloupe, gardenias, catalpa, centaurea, cherry, chicory, chokecherry, chrysanthemum, clematis, coleus, coltsfoot, many columbines, convolvulus, many coreopsis, the cotoneasters, cotton, geranium, crocuses, cucumbers, many currants, cyclamen, dahlia, common dandelion, many of the dogwoods, elder, elm, English ivy, English oak, eucalyptus, European Mountain-ash, evening primrose (Oenothera). Among the ferns, the Bladder fern, Brown's, Xmas, Goldie's, Maidenhair, Sword and Walking can bear a slightly alkaline reaction. Then there is sheep fescue, fleece flower, flowering quince, forget-me-not, foxglove, meadow foxtail, gentian, gladiolus, globeflower, many of the goldenrods (*not* those listed in the roll-call of the acid lovers), some species of grapes, orchard grass, velvet grass, groundsel, hawthorn, heliotrope, hepatica, honey locust, honeysuckle, horseradish, houseleek (sempervivum), common hyacinth, some junipers, kale, laburnum,, larch, larkspur, leek, lilac, linden, lobelia, locust (Robinia), loosestrife, lungwort (the color of the blossom will differ on acid and alkaline soils), many of the maples, mariposa, marjoram, common mignonette, many of the mints, mock orange, monkshood, morning-glory, mulberry, narcissus, nasturtium, most nightshades (but be careful with tobacco and potatoes), white swamp oak, okra, many oxalis, pansies, parsley, parsnip, passionflower, paulownia, peas, peaches, pears, peonies, periwinkle, petunia, annual and garden phlox, many of the pinks, plane tree (Platanus), plum, poinsettia, poplars, poppy, prickly-ash, primrose, privet, radish, most roses, rose mallow, sage (particularly the wild, desert sagebrush), saxifrage, snapweed, common snowdrop, Solomon's-seal, other veronicas than the Spike Speedwell, spirea, spiderwort, squash, squill, Star-of-Bethlehem, some of the sedums, St. John's-wort, sugar cane, sumac, sunflowers, sweet clover, tamarix, turnips, verbena, viburnum, some of the violets, walnut, water cress, white oak, willow, wisteria, wormwood, yew, yucca, zinnias.

(*Continued on page* 45)

**Mrs. Edson breeds geese because she finds them a good cash crop and she likes their friendly talkativeness.**

# The Wife Is the Farmer

## *An Enterprising Wife Manages An Organic Farm While Her Husband Works in Town*

## By ALDEN STAHR

IN THE report on our own farm in the second issue of *The Organic Farmer,* I mentioned a phone call from another organic farmer who had found it impossible to get phosphate rock in New Jersey. I had fortunately been able to get some from a superphosphate plant before they adulterated it with sulfuric acid, so we made up a tonnage order together. Then, during the summer I happened to ride by this farm and saw a sight unusual in this countryside of sorry-looking abandoned fields, a stand of rye and vetch six feet high, blue with blossoms and the plants the rich dark green of healthy vegetation. No one was at home that day, but I stopped by again last week as I thought other organic or prospective organic farmers might find interesting a report on the agricultural activities of Mr. and Mrs. James Edson and their son James, Jr., part-time organic farmers of Warrenville, New Jersey.

When I started to ask Mr. Edson about the farm, he grinned and said, "You'll have to talk to my wife about that. She's the farmer around here." And so she is. Mr. Edson is an engineer at Bell Telephone Laboratories and, although he takes some part in the farming activities, it's Mrs. Edson who is the farmer. But she did confide that it's mighty handy to have an engineer on the farm when the combine breaks down.

As a matter of interest I ask all organic farmers I meet what started them on the right road and you'd almost think I had paid for a testimonial from Mrs. Edson. "A friend sent us an *Organic Gardening* booklet through the mail," she said. "It all made sense to us so we started the organic way when we bought this run-down farm two years ago."

And run-down it was. The orchard was completely fruitless and when they hired a neighboring farmer to plow a field he broke a couple of shares trying to get the plow into the ground. It's sometimes puzzling to me, in interviewing organic farmers, to find that just about every one has started with a run-down farm. I guess the answer is that there isn't any other kind in areas where the chemical doctrine has been faithfully followed and the organic content of the soil has been run out to zero. At any rate, the Edsons are situated in an ideal place to remedy the worn-out condition their soil was in; they're within a half mile of a row of commercial chicken farms and haul about one hundred tons of chicken manure a year from these to spread on their fields. In addition they spread the manure and bedding from their own cattle and poultry and use rye and vetch as a cover crop.

The day I was there a boy from one of the chicken farms was spreading on a hay field and it seemed curious to me that nothing was coming off the back end of the spreader. On closer examination I saw that the spreader mechanism was on the front end of the spreader and was power driven from the tractor. The reason for using this type spreader is that it is easy to back right up to the chicken house doors and the power drive makes for even spreading in slippery spots where the drive wheels of conventional spreaders sometimes lock and slide, as mine have done on occasion.

The Edsons find a power spreader efficient in mud.

These cows are

As an indication of how well the organic treatment is building up the soil we have simply to look at comparative wheat yields for the first and second years—nine bushels per acre the first year, thirty bushels per acre the second year. The fields were limed the first year and had the advantage of more organic matter plus phosphate rock the second year.

Since the vetch used for a manure crop was so inexpensive, the Edsons decided to combine for seed for additional cover cropping and enough seed escaped the combine in the dense jungle growth that there is now (in December) a thick cover of volunteer vetch grown without effort or cost. This was grazed until December but I still could not find the ground through it.

Next to the vetch was a field of husky-looking corn which had been grown without plowing or chemical fertilizer and had not been cultivated all summer. The plot was weedy, to be sure, but in spite of the weeds and the longest drought in New Jersey history the Edsons had a good yield of corn, certainly a testimonial for the organic method and a good argument for leaving the organic matter at the surface. Mrs. Edson does not plow, but uses a Ford field cultivator and a disk to prepare her fields. She says she knows that passing farmers must criticize the trashy appearance of her fields when they're ready for planting, but they also admire the emerald green of the growing crops. In fact, one neighbor was so impressed with the results of the organic method that he now lets her work his farm without charge, so she is now reclaiming brush and cedar-ridden fields on R. V. V. Miller's adjoining farm and restoring the fertility with manures, lime, phosphate rock and rye-and-vetch cover crops.

Because of this necessity for rebuilding the land and rebuilding the barn, the Edsons are not operating at a profit at present, although some income is realized through the sale of geese, beef, eggs and pork. At first, they had a little difficulty in disposing of their surplus farm products, but all their customers needed was one taste and they came clamoring back for more. At present the Edsons have one cow milking, one bred heifer and two unbred, a steer and three calves. All except one of these are consumers just now, but once in production with either milk or meat the investment will begin to pay off.

The animals are organically fed and are completely free of disease. Their feed is ground in a hammermill and is made up of wheat and oats plus salt, bonemeal and molasses. The fifty sex-link hens are fed organically, too, and are in beautiful condition. The Edsons' original flock, obtained from a neighboring chicken farm, had not been fed organically and acquired Newcastle's disease along with most of the other chickens in the neighborhood. The sex-link hens were bred by a cross-breed rooster and the eggs hatched in the incubator in the kitchen. Mrs. Edson was amazed to get 100 % fertility, because she had been told by commercial hatcherymen that 65% was all she could expect. "You can't tell me there's no difference between the yolk of an organic egg and the yolk of a commercial egg," said Mrs. Edson. "If they're so much higher in fertility they must be higher in food value for human consumption, too."

The geese, too, enjoy perfect health and fertility. This year Mrs. Edson is keeping over nineteenWhite Emdens and White Chinese for breeding. While she has no present thought of going into goose breeding

cropping an organic pasture in January.

The Edsons till with a Ford field cultivator.

on a large scale, she keeps this small flock for an easy cash crop as part of her diversified scheme of farming and also simply because she likes the friendly and talkative birds.

As to equipment, the Edsons had a much more complete line than I had expected to find on a part-time farm. In addition to a Ford tractor and the usual field-working and haymaking machinery, they find it expedient to operate their own combine. With this they can harvest their own grain when it's ready and not have to lose a crop because a contract farmer is too busy to get there at the right time. On occasion, the Edsons have come to their neighbors' rescue when no other combine was available and find, as other part-time farmers do, that an expensive piece of equipment can help to liquidate its own cost by part-time contract work.

In addition to their standard crops like corn, wheat, etc., the Edsons tried a field of millet and found that it made a heavy growth even under the hot-dry conditions of the summer of 1949, while the soy beans in the next field, under the same circumstances, did poorly because of the lack of moisture. They combined the millet and use the plants for hay. It is quite coarse and brittle and all their cattle except a fastidious Guernsey love it. The millet shatters easily when combined and enough seed fell to cover the field with volunteer growth. Mrs. Edson has tried to find out if the millet will winter over in this latitude, but she will have to wait until spring for her answer as no one around here seems to know. At any rate, she now has millet seed to sell as a result of her experiment.

The fruitless orchard mentioned at the beginning of the article provided a surprise this year. The tree nearest the goose pen was liberally mulched with litter, manure, leaves and chopped corn cobs last year and this past summer bore worm-free fruit without spraying while the rest of the orchard bore no fruit at all. The other trees had had some blossoms but the frost which killed them did not affect the mulched tree, which had the two or three degrees extra warmth that made the difference in blossom survival. This mixed mulch practice will be extended to the rest of the orchard as time and materials allow.

The Edsons made compost the first year but not the second, as the drought was too persistent to allow organic matter to decompose. They found that sheet composting made better use of the small amount of rain than heap composting, and required less work.

Now working about thirty acres, Mrs. Edson may expand the acreage but it will remain a part-time organic farm, as Mr. Edson plans to keep an being an engineer. In this it differs from many part-time farms, which somehow become full-time farms. However, this is more than a subsistence farm as the Edsons will soon be supplying many people with organic foods as their investment of time, effort and money begins to pay off. That it has already paid off for the Edsons personally is evident in their abundant good health and happiness and in the comfortable feeling of having a forty-cubic-foot freezer loaded with organically-produced food.

And like so many other organic farmers their success and enthusiasm in the organic method spread beyond their own boundaries as their neighbors *see* and *taste* the advantages of organiculture.

# New York's Water Shortage

## *A Letter to Governor Dewey And Mayor O'Dwyer*

**By J. I. RODALE**

Dear Sirs:

As editor of *Organic Gardening Magazine, The Organic Farmer,* and as President of the *Soil and Health Foundation* of Allentown, Penna., I feel it incumbent upon me to write you about an aspect of the water shortage in New York City which is being overlooked. That is, the use of chemical fertilizers in agriculture. For eight years I have observed and studied the fertilizer problem and proved beyond doubt that unless man ceases to use these artificial fertilizers and substitutes the more absorbent organic fertilizers to draw in the rain, the big cities some day will really have a water supply problem. And not only New York. This is a national problem, affecting many cities.

What we see today is as nothing compared to what might come in the future. My contention is that chemical fertilizers harden the soil so that too much of the rains, instead of going into the soil, wash off into the rivers and from thence go into the oceans. Part of New York City's water supply today is in the ocean, and in the process of going there it has carried away some of the finest part of the soil, the top-soil. So there are two disadvantages. We not only lose drinking water, but the farmer loses precious top-soil.

I do not say that chemical fertilizers are the only factor in the drinking water supply equation. There are others. However, I can prove that not only is this the most important one, but that if this part of it is adequately taken care of, the others cannot do any harm.

To my desk over the years as editor have come hundreds of letters from our readers who have been following the organic method of farming, that is, doing away entirely with chemical fertilizers and substituting organic matter such as decayed manure, weeds, leaves, other organic residues and ground up, mild rock powders for extra minerals. This method gives the soil porosity and encourages the earthworms to burrow and make channels in the soil down which rain can pour. Our readers report an increased retention of rain waters.

Let me give you the story of my own farm. Eight years ago we bought 63 acres near Allentown which were terribly run down. Chemical fertilizer use was a prominent factor in creating this condition. The soil surface was in hard crusts that could be picked up. The rain was a difficult problem here. A farm is usually in a watershed of many farms. The rainwaters began on the first farm and the over accumulations go from farm to farm until they land up in the middle of such a watershed. It seemed that we received the rainwater from several farms above us whose soil had a hard-pan. By the time the water came to our place it began to rampage a bit, and all of it, like a Niagra, landed in the grounds where the house and barn were located, washing out the road and doing other damage. Then the waters went their way to other farms in the watershed, removing much top-soil.

We began the practice of the organic method, but not knowing what the results would be, we spent a thousand dollars building a drainage system to control the waters in the home grounds. However, after two years of farming by the organic method, and putting into the soil fertilizer that had body, rather than powders from the chemists' bags, I was amazed to find that we could hold more than ¾ of all the water,

THE CONDITION OF FARMLAND IS VITAL TO THE SECURITY OF URBAN WATER RESOURCES.

not only our own but that of the farms above us, and we were sending precious little of it to the remaining farms in the watershed. My $1,000 investment in drainage facilities would not have been necessary had I realized what was going to happen.

We were able to hold back *all* of the water when several years ago, in addition to the organic method, we adopted strip contouring of our fields. That is, we plowed in such a manner that rain water was rerouted so as not to run down hill in any one place, which would increase the velocity of the running water. The slower the water runs, the more of it will seep into the ground.

You will ask, "but what about the practicability of such a suggestion from the economic point of view?" Don't chemical fertilizers increase yields? They do, but it is like a drug. More and more chemicals are needed as time goes on to get the same results, and these chemicals interfere with the bacteria of the soil, killing some and causing the wrong kinds to multiply. The soil's fertility is partially controlled by the bacteria and fungi which must be permitted to function in a natural manner. Organic matter is a natural food for them. Chemicals are like a shot-in-the-arm—all right as a temporary measure, but not as a regular diet.

But the organic method, many have found, has given even higher yields than chemical fertilizers. This year on our farm our corn yielded 59 bushels to the acre, while neighboring farms averaged 46.5 bushels. Our barley yielded 43 bushels, while the average for our area was 30. Our 34 bushel yield of wheat compares well with the 22.5 bushel average. We had 35 bushels per acre of oats, while the average was 30 bushels.

The other day I read where Chief Engineer Edward J. Clark of New York City said there was a day of rain that was expected to add 5,500,000,000 gallons—about five days' supply—to the two thirds empty reservoir. Now, if the farm lands above New York City, that feed the reservoirs, had plenty of organic matter in the soil, instead of adding only five and a half billion gallons of water to the reservoirs, a one day rain might add ten or twenty billions of gallons, and there never would have been a shortage in the first place.

In the case of New York City's water problem the factor of chemical fertilizers may not be as important as in other regions which are so fortunate as to have so many forests in the midst of the reservoirs. But

if the engineers will check they will discover that there are farms within feeding distance of the water supply. In fact, water tables are not only fed, but drained by sources quite a distance away.

It is a simple matter to prove. Let the city engineers go up to those sections that feed the reservoirs and test the average hardness of the soils of farms nearby and let them come to our and other organic farms and make tests. They will see at once what must be done in the future if man wants to continue to use water.

There is a revolution going on in agriculture at the present time. We organiculturists, as we are called, are a loud minority, but our movement is spreading and many powerful persons are joining the ranks. Most people come into the fold because of the fact that food produced by the organic method as nature does is healthier than that grown with chemicals. We have the scientific evidence, as well as the results shown in the improvement of health of persons eating such food, but there is no room to go into that phase here. Suffice to say that the father of the organic method was the late Sir Albert Howard of England and India, and my book *Pay Dirt* (Devin-Adair Co., N. Y.) gives the history and the science back of it.

The present water shortage is an indication that perhaps we are letting science drag us too far. We may be suffering at this moment from too much science. By using chemicals in farm fields, we may have to put chemicals in the N. Y. City water reservoirs. If the water levels get too low they are talking of treating it with chlorine or copper sulphate, poisons which you may have to drink. In other words you may be forced to drink a chemical, because another chemical was applied to a farmer's field.

This water shortage also should prove to the city person that he is definitely and directly effected by agriculture. He cannot divorce himself from it. The pretty lady who sips a cocktail on Park Avenue, must be concerned about the proper use of the manure heaps on up-state New York's farms. She must understand that the proper placing of that manure in the farm soils will give her more and better drinking water.

There are other ways that the cities must help the farm lands. One of them is by not burning up the garbage. The farmer raises a carrot and the city man eats it and throws the green tops of it into the garbage can. Then it is smugly dumped into the ocean. The garbage is a wonderful organic fertilizer which, if composted or decayed properly, can not only make food grown with it much healthier as a fertilizer, but it can furnish the blotter, the sponge, to aid the soil to drink in more rain. It is the law of return. Dust thou art and to dust thou returneth. Your garbage must turn to dust and be given back to the land. The city man, and the city government, must be conscious of their obligations.

Ferari, the great historian, attributes the fall of Rome to an abuse of Agriculture. The city Romans reclined cozily at their banquets, while slaves ran their farms and ruined the land. I wonder what was done with the city garbage in old Rome. It is interesting to note that part of Newbold Morris' (the republican candidate for mayor in the recent election) platform was that if elected he would compost Staten Island's garbage. It would be a wonderful thing if Mayor O'Dwyer could be non-partisan in this matter and place Morris in charge of such a project. The city of Miami, Florida has just let a contract for such disposal of its food wastes.

Yes, garbage, politics, the city man, the farmer, and water are all in the same wagon. The formation of a federal commission to study the water problem was proposed by Senator Irving M. Ives, of New York because many other cities face similar crises. If such a survey is undertaken, I trust they will not overlook the effect of the use of chemical fertilizers on the nation's water supply.

As a suggestion on the handling of New York City's garbage as well as its water problem, let the garbage be placed in freight cars of the gondola type, being finely ground first, and thoroughly mixed with certain bacterial cultures. As it travels to New York City's water supply region the freight car at several points goes on an overhead track and automatically dumps its load below into another freight car. This should be done at at least two points, to aerate the mass of garbage and to permit the bacteria to work more effectively. The freight cars should lay over in yards so that the material is kept two days. It will turn the garbage into a nice black mass with the texture of soil and without any of the garbage odors left, thanks to the wonder-working bacteria. It is now ready to be placed on farms in the regions that feed New York's water supply. The theory of *eminent domain* can be invoked in the interest of the public's welfare to work out the details.

Mr. Frazer of the Kaizer-Frazer Company has gone into this field of garbage reduction and is now building a huge digester in the Chicago stock-yards and is part of the revolution to eliminate eventually the use of chemical fertilizers. We are in a chemical age. No matter what the problem is, we go to the chemist for a solution. He puts his powders into our drinking waters and into the fields. He puts it at seven different steps into the manufacture of bread. He puts it into everything we eat. There are people who believe that our destruction eventually as a civilization will be brought about by our knowledge and misuse of chemicals. This water shortage is only one little symptom. There is poliomyeletis. Others and worse ones, may follow. Rome did not fall in one day. Historians say it took hundreds of years. We may be in the process of falling right now.

Sincerely,
J. I. Rodale
Editor, The Organic Farmer
Emmaus, Pa.

## Trace Elements Are Medicine—A Theory

# Another Look At Trace Elements

### Part Four

## By LEONARD WICKENDEN

IS IT possible to discuss, in simple terms, the role of trace elements in agriculture, without sacrificing accuracy? I think it is. In broad terms, it is maintained that a deficiency of these elements results in an unhealthy plant and that the commonest manifestation of lack of health is retarded growth followed, or accompanied, by what the scientific man calls a chlorotic condition. In simple English this means a yellowing of the leaves.

The scientist looking at the plant would say: "There is a manifestation of chlorosis;" the common man would say; "Looks kinder sick, don't it?" It looks sick because it is sick and it is usually a fair assumption that it is sick because there is something wrong with the soil in which it is growing. The yellowing, we are told, may be due to a deficiency of manganese, or iron, or copper, or magnesium, or a mixture of all or some of them. If certain elements are added to the soil under the right conditions and in the right amounts, the chlorotic condition clears up; or, if you must have it in good English, the leaves turn green. This, say the scientists, proves that the sickness was due to a deficiency of the elements that brought about the cure.

Does it prove that? Obviously not. All it proves is that the sickness, or the symptoms of the sickness, can be eliminated by the addition of certain elements to the soil under prescribed conditions. That is an entirely different matter from proving that these elements are essential to the health of the plant.

To make that clear, let us consider an analogy. I suppose it is safe to say that at least half the people who read this article have suffered, at least once in their lives, from a headache which they cured by swallowing an aspirin tablet. Did that mean that the diet of these people was deficient in aspirin? Did it demonstrate that their food should, in future, be enriched with 10 parts per million of aspirin? Did the aspirin even remove the unhealthy condition which caused the headache? I do not believe even the manufacturers of aspirin would claim any of these things.

How do we know that the effect which trace elements have on plants is not analogous to that which aspirin has on human beings? In other words, is it not possible that trace elements are medicine rather than nutriment? It seems to me that many of the specialists whose articles and papers I have been reading are saying, in a rather roundabout and obscure manner, that they *are* medicinal and some even suggest that it is sick soil that needs the dose rather than sick plants. The mere fact that trace elements in slight excess become toxic is a further indication that they are medicinal rather than nutritional.

It does seem that when the food manufacturing process is not functioning efficiently, trace elements frequently put matters right; add them to the soil and the plant becomes more vigorous. The question arises —is there any substance *other than* the trace elements which will do a similar job? Does boron or zinc or manganese merely correct a faulty condition or is it a normal ingredient in plant metabolism?

These questions lead to a third — can a plant be healthy if it is growing in soil which lacks any one of these "essential" elements? If it can, the case for that particular element falls to the ground. In other words, if a plant will grow healthily in a soil which, for instance, contains no trace of iodine, then iodine, clearly, is not an *essential* element.

What efforts have been made to answer these questions? As far as I can discover, not very many. The starting point of an investigation has almost always been a sick plant — not a healthy one. The soil scientists encounter or create a state of unhealth and set to work to find a cure. Having found one, they conclude that it is the only one, and that the element which provided it is essential to every plant growing in every part of the world. Is that a justifiable conclusion? Should they not approach the problem from the exactly opposite direction and collect, from all parts of the world,

# Another Look at Trace Elements *Continued*

samples of hundreds, even thousands, of soils in which plants are growing healthily and determine whether every one of them contains all the elements which are held to be essential? If they find only one in which only one such element is missing, their theory is seriously weakened. If they find many, the theory must be abandoned.

### No Iodine In the Northwest

The chief chemist of the Research Department of the Chas. H. Lilly Company, in his article in *New Agriculture,* writes:

"We have never found even a trace of iodine in any soil in the Northwest. The largest amount of boron we have found is 4.4 lb. per acre. We have not found more than 10 lb. of copper on any acre, more often only a mere trace. We have never found enough sulphur on any one acre. . . . We have found no cobalt, very little manganese and little if any zinc.

The writer argues from these discoveries that the farmers of the Northwest should straightway buy these trace elements and add them to their fields. To me, it seems that the Northwest would be a good place to start our quest. Here we have soil aplenty which, according to Mr. Vanderlinden, is woefully deficient in most of the trace elements which are held to be so necessary to the health and productiveness of crops. One would assume that the state of Washington must, then, be a barren dessert with here and there a few sickly plants dragging out a weary existence from which they pray that death may soon release them.

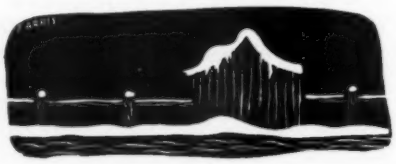
What are the facts? Statistics published by the U. S. Department of Agriculture put the state of Washington high on the list for yield per acre of corn, wheat, barley and oats. During the ten years 1930-39 (long before Mr. Vanderlinden's depressing revelation) Washington, in the list of 48 states, stood 14th on corn, 6th on wheat, 4th on barley and 1st on oats.

Think of it! No iodine! No cobalt! Usually a mere trace of copper and zinc! Very little manganese and boron! Clearly, without these "essential" elements the farmers of the state could not possibly raise satisfactory crops. But they did not know that so they went ahead and did it and came out far ahead of most of the other 47 states. Where does that leave the theories of the micronutritionists?

Exception may be taken to my statement above that the soil scientists "create a state of unhealth." Let me explain. In determining the effect of various elements on plant growth, a very common procedure would be to sow the seeds of the plant in sand. To the sand would then be added solutions of various chemicals to "feed"the plant. I call that creating conditions of unhealth because the plant is being deprived of the very conditions which guard its health. I do not believe it is sound to assume that a plant growing in such a medium is representative of truly healthy plants growing in fertile soil and I cannot rid myself of scepticism regarding the value of conclusions drawn from experiments carried out under such artificial conditions.

### Organic Matter Prevents Trace Element Deficiencies

It seems to me at least possible that plants growing in such media could not fail to show symptoms of ill-health and that the copper, boron, zinc and other elements are curative agents rather than nutritional necessities. I do not say it *is* so. I only suggest that the conclusion that *all* plants need these elements has been reached too hasitly on insufficient evidence.



As we have seen, symptoms indicating deficiency do not occur when manures and composts are used. Dr. Drosdorff, of the U. S. D. A., explained this, you may recall, by stating that manures and composts "usually contain a balanced amount of the minor elements." I wonder if he *knows* that or if he merely *assumes* it? I wonder how many samples of manures and composts have been analyzed and from how many different parts of the world they were taken. Soils vary so greatly in character that it would indeed be strange if all, or even nearly all, manures and composts (the ingredients of which originate in the soil) contained every trace element in the correct proportion.

But let us suppose that Dr. Drosdoff is right; does that not still leave him in something of a dilemma? He admits—we all admit—that if trace elements are added to the soil in excess they become toxic. Also that the margin between helpfulness and harmfulness is very narrow. But composts and manures are used in widely different amounts. One farmer may use 5 tons to the acre, another 10, a third 20. If the crops of the first farmer are healthy, then a dressing of 5 tons must give all the trace elements needed. But then the third farmer would be adding four times the beneficial amount and his soil would become toxic. If evidence exists that trace element poisoning follows the use of large quantities of compost, I do not know of it. I do know that I have, myself, at times fed a plant or crop very heavily with compost and the results have been entirely beneficial with no sign of poisoning. Does not this indicate that manures and composts contain some other ingredients which assist the plant in manufacturing its food as efficiently, or perhaps more so, than do the trace elements. Once again, we do not know. We can only surmise.

—EWING GALLOWAY

YOUR GREEN MANURE CROPS BELONG TO THE SOIL—LEAVE THEM THERE.

# It Isn't Yours to Harvest!

## By WM. P. COLEMAN

MOST farmers believe in organic farming although not all practice it. Some believe they can't afford to return the crop to the soil. Others sometimes put in a green manure crop, determined to plow it under at the proper time, but a few months later, with a half dozen or more cows to feed, they succumb to the temptation to harvest it.

Then, says the farmer, "I'll cut and cure that field and save buying hay. Next year for sure, I'll have a green manure crop." But it happens again in the following year as immediate needs put more value on the crop as feed, and it becomes increasingly difficult to maintain a hands off policy.

When a crop is put in for green manuring, it should be used only for that purpose. Determine that if necessary, you will run up a feed bill or even borrow money rather than remove the crop. Don't let anything prevent its being plowed or disced into the soil.

At home, we formerly had many unpleasant moments because bills that should have been paid were let slide and we used the money for less worthy purposes. My wife and I often discussed our inability to get completely out of debt. It was very evident that she gave prolonged consideration to the subject, for one night she came up with the solution.

"We'll have to change our attitude," she said, "before we can get out of debt. When we take in some money, we feel it is our money and to be used as we see fit. But it doesn't really belong to us because we owe $30 at the hardware store, feed dealer and the gas station.

"Right now we have a check for $25, but it isn't our money because we owe $30 at the hardware store alone. The bill isn't due for another 10 days, but that $25 belongs to the hardware store just the same."

That sounded reasonable. We started at once to follow the principle that all income, except what was needed for the table or an emergency, belonged to creditors until all bills were squared. We took a great interest in watching our indebtedness vanish as more and more income was applied. And once we had

# It Isn't Yours To Harvest

*Continued*

mastered the art of spending, it was remarkable how many necessary and substantial things our income would cover.

You should look at your organic crop in the same light. That crop does not belong to you and is not yours to harvest. It does not belong to your livestock and it not theirs to eat. It does belong to the soil and you are merely holding it in trust until the proper time to return it to the soil.

It is easy to dillydally about starting an organic farming program, as I well know from experience. I was not a farmer when, some years ago, I bought a 60 acre place in southwestern Michigan. The real estate dealer showed me the place and we stood at the back of the house and looked out over a broad expanse of green growth about three feet high.

"You can see," he said with a sweep of his hand,"that this place isn't blow sand and that it will grow something."

Yes, I saw that, all right. We made the deal. In October the entire farm was burnished with golden rod, and I then realized what that growth could be. It was that mostly, with some quack grass, pig weed, rag weed, horse nettle, Canada thistle and sand burrs.

After we were located on the farm, we began to learn things. For instance, that it had been rented to a new tenant each year for the past 35 years. Each tenant planted 60 acres of corn and sold stalks and all off the place. No fertilizer or organic material was put back into the soil.

"But," said one neighbor, "that was the best farm around here forty years ago. It raised 40 bushels of wheat to the acre."

Next spring I plowed 15 acres and planted field corn in the belief that it would give the yield of a normal five acres. When the shredder moved into our barnyard that fall, my corn crib with a capacity of several hundred bushels was ready. I pulled the farm wagon up to the corn shredder and set it under the grain spout.

By nightfall, the 15 acres of corn (all that had been large enough to cut and shock) had passed through the machine. I hadn't once moved the wagon and I gazed glumly at a measly little heap of corn nubbins that wouldn't weigh five pounds. A jumbo basket would have served the purpose of catching the grain.

It was almost unbelievable that the farm could be so poor. We had no money to go in for large scale organic farming, yet the need for it was plain. Our problem was further complicated by the fact that we had to get our living day by day from the soil.

I fenced a three acre field adjacent to the barn and put in emergency grazing crops for the livestock. I put in five acres of buckweat to plow under, but around harvest time I would have taken the grain for the chickens if the yield was good. The stand was very thin and stunted and it was regretfully disced into the ground.

Rye was sown in this field at once as a green manure crop, but it, too, was thin. Neighbors said that if harvested, it wouldn't make five bushels to the acre, so under it went.

For three years, corn was planted on a new 15 acre piece and results were heartbreaking except for the small area on which we forked manure. Corn did no better where buckwheat and rye had been disced in. Ten acres were treated with hydrated lime and seeded to alfalfa. It failed. Next year the same field was sown to sweet clover and it made a scanty stand. It was left for two years and then had to be cut for hay. Practically all the feed for livestock and chickens during five years was paid for with money pinched from our own table.

In the meantime, the three acre field had provided a succession of grazing crops. Rye did poorly the first year, but the yield gradually rose year by year. In the fifth year, 15 head of livestock ran in this field all season after grazing to the roots. They were fed morning and night at the barn and at noon had green corn and roadside cuttings. Finally, in midsummer, most of the livestock was sold.

This three acre field was put into field corn the following year and I intended to plant another 15 acres but never got around to it. The corn got off to a good start; it had sturdy spears and was of good color. Even so, it didn't seem that the few crops grazed and plowed under with the urine and manure could have a telling effect, and when the stalks reached a height of 10 feet, most with two heavy ears, I was astonished at what organic farming can accomplish even on that scale.

That fall, I made good use of the corn crib that was constructed five years earlier and the mow was full of shredded fodder. For the first time, we bought no straw for bedding, and the cows were deeply bedded all winter. In spring, tons of shredded fodder were forked out of the mow and drawn out on the land for plowing down.

In the beginning, because of being in very poor circumstances, I thought I couldn't afford organic farming. The three acre field proved that I couldn't afford to disregard it. And I have since seen proof that organic farming will give yields much greater than average in any crop.

The farmer who thinks he can't afford to plow under five or ten acres of organic matter is only erecting barriers to his own prosperity. He is putting off the day when he can get greater yields from fewer acres, less hours in the field and more time to enjoy life and his farm.

# The Nature of Soil Fertility

## Wholesome Soil Produces Premium Crops

### By SIR ALBERT HOWARD

Reprinted from An Agricultural Testament

The influence of humus on the plant is not confined to the outward appearance of the various organs. The quality of the produce is also affected. Seeds are better developed, and so yield better crops and also provide live stock with a satisfaction not conferred by the produce of worn-out land. The animals need less food if it comes from fertile soil. Vegetables and fruit grown on land rich in humus are always superior in quality, taste, and keeping power to those raised by other means. The quality of wines, other things being equal, follows the same rule. Almost every villager in countries like France appreciates these points and will talk of them freely without the slightest prompting.

In the case of fodder a very interesting example of the relation between soil fertility and quality has recently been investigated. This was noticed in the meadows of La Crau between Salon and Arles in Provence. Here fields are irrigated with muddy water, containing finely divided limestone drawn from the Durance, and manured mostly with farm-yard manure. The soils are open and permeable, the land is well drained naturally. All the factors on which soil fertility depends are present together—an open soil with ample organic matter, ample moisture, and the ideal climate for growth. Any grazier who saw these meadows for the first time would at once be impressed by them: a walk through the fields at hay-making would prepare him for the news that it pays the owners of high-quality animals to obtain their roughage from this distant source. Several cuts of hay are produced every year, which enjoy such a reputation for quality that the bales are sent long distances by motor lorry to the various racing stables of France and are even exported to Newmarket. The small stomach of the racehorse needs the very best of food possible. This the meadows of La Crau help to produce.

The origin of these irrigated meadows would provide an interesting story. Did they arise as the result of a set of permanent manurial experiments on the Broadbalk model or through the work of some observant local pioneer? I suspect the second alternative will be found to be nearer the truth. A definite answer to this question is desirable because in a recent discussion at Rothamsted, on the relation between a fertile soil and high-quality produce, it was stated that no evidence of such a connexion could be discovered in the literature. The farmers of Provence, however, have supplied it and also a measure of quality in the shape of a satisfactory price. For the present the only way of measuring quality seems to be by selling it. It cannot be weighed and measured by the methods of the laboratory. Nevertheless it exists: moreover it constitutes a very important factor in agriculture. Apparently some of the experiment stations have not yet come to grips with this factor: the farmers have. The sooner therefore that effective liaison is established between these two agencies the better.

The effect of soil fertility on livestock can be observed in the field. As animals live on crops we should naturally expect the character of the plant as regards nutrition to be passed on to stock. This is so. The effect of a fertile soil can at once be seen in the condition of the animals. This is perhaps most easily observed in the bullocks fattened on some of the notable pastures in Great Britain. The animals show a well-developed bloom, the coat and skin look and feel right, the eyes are clear, bright, and lively.

Resistance to insect and fungous disease is also conferred by humus. Perhaps the best examples of this are to be seen in the East. In India, the crops grown on the highly fertile soils round the 500,000 villages suffer remarkably little from pests.

Soil fertility not only influences crops and live stock, but also the

fauna of the locality. This is perhaps most easily seen in the fish of streams which flow through areas of widely differing degrees of fertility. An example of such difference is referred to at the end of Chapter V of Isaac Walton's *Compleat Angler* in the following words:

"And so I shall proceed next to tell you, it is certain, that certain fields near Leominster, a town in Herefordshire, are observed to make sheep graze upon them more fat than the next, and also to bear finer wool; that is to say, that in that year in which they feed in such a particular pasture, they shall yield finer wool than they did that year before they came to feed in it, and coarser again if they shall return to their former pasture; and again return to a finer wool, being fed in the fine wool ground. Which I tell you, that you may the better believe that I am certain, if I catch a trout in one meadow he shall be white and faint, and very likely to be lousy; and as certainly if I catch a trout in the next meadow, he shall be strong and red and lusty and much better meat: trust me, scholar. I have caught many a trout in a particular meadow, that the very shape and enamelled colour of him hath been such as hath joyed me to look on him: and I have then with much pleasure concluded with Solomon, 'Everything is beautiful in his season.'"

Soil fertility is the condition which results from the operation of Nature's round, from the orderly revolution of the wheel of life, from the adoption and faithful execution of the first principle of agriculture—there must always be a perfect balance between the processes of growth and the processes of decay. The consequences of this condition are a living soil, abundant crops of good quality, and livestock which possess the bloom of health. The key to a fertile soil and a prosperous agriculture is humus.

# Report From The Skagit Va

## *Sheet Composting Spreads In the Northwest*

**By JACK VAN CLUTE**

SLOWLY but surely Nature is going to have her way in one of the richest agricultural areas of the country. In Skagit Valley, Washington, where approximately 100,000 acres are in cultivation, Nature showed farmers the error of chemical ways. Today some 2,500 acres are being sheet composted and getting applications of "Ol' rock phosphate," as the owners put it.

More remarkable still is that the change-over to organiculture is being made despite high pressure salesmanship from chemical firms. The start of the organic trend came two years ago. It was due to what chemiculturists term an emergency, though to the Nature student the move was natural. Dairying declined in the valley when it was found that an acre would net more returns in seed crops than in milk. So raising of green peas for the locker and seed crops of turnip, cabbage, spinach and beets took over. It was an economical turn, and pleasing. Instead of six hours daily with cows the year around, it was only a few weeks' work harvesting seed crops, and the rest of the farmer's time was leisure. And when it came to replenishing the soil it was easier to buy chemicals by the car load. That was cleaner work, too, than hauling manure.

But with chemicals there came a natural reaction that definitely was on the deficit side of the ledger. Chemicals resulted in diminished returns and begot problems of virus, weed and insect pests to which the farmers had a natural reaction because their pocketbooks were hit.

To one group of land owners came the seasonal rush of vining green peas. That crop must be harvested right now because a delay of even one day may mean the difference between profit and loss. Customarily, pea threshings are stacked to be sold to dairymen. But shorthanded, this group of men resorted to trucking the threshings from the viner and dumping them on the field, with every intention of stacking later. But the weather man intervened with a few days of rain, and when the sun broke, the dumpings were a smelly mess. More to get rotted vines out of way than to utilize their fertility value, they were spread over a few acres of the field, and disked into the ground. With that, Nature went to work and

# Valley

brought forth something strange to that part of the valley—Mycorrhiza—the "fungus bridge between soil and sap," according to the late Sir Albert Howard.

The pay-off came last summer. The pea-vined acreage produced some of the tallest and best oats the owner had ever grown, while the adjacent area produced only sub-normal grain. That was an eye-opener. Hitherto, the farmers had worked to clear all fields of trash and weed growths, had even resorted to burning off fields during dry weeks of Fall. But last fall that 80-acre field received a dressing of one ton each of raw rock phosphate and ground limestone per acre and an application of pea vines, then was sown to winter rye. The rye now is a deep green carpet for sheet composting in Spring.

Since Mycorrhiza are fungi, the land owners got to wondering if they had seen much fungus develop from inert chemicals. They hadn't, hence the adoption of organics.

Walter Johnson, a valley pioneer, and his sons, Glen and Curtis, farm over 300 acres, and until two years ago they stacked all pea vines and burned turnip threshings in the wake of combines. After noting crop results when vines were turned back to the soil, they began switching to organiculture and declare that there will be no vine stacking next summer. "Instead, the vines will return to the soil so that Nature can take her course," says Mr. Johnson.

More encouraging still, the Johnson turn to organiculture is being followed by other valley farmers with indications that the movement will sweep the whole valley within a few years. Limestone, rock phosphate and cover crops of rye, legumes and all weed growths are in the back-to-the-land movement. Last Fall 60,000 tons, or about four-fifths of the total amount of phosphate fertilizer bought in the valley, was raw rock phosphate.

Last Fall too, Nature had another way—a hard way— of demonstrating the advantages of organiculture in the valley. The Skagit River, born of winter snows and glaciers locked around Mount Baker and Mount Shukshan sixty miles northeast, forks through the valley to its final objective, Puget Sound and the ocean. To protect the flatlands the river is diked high. But at time of high tides last November 26 a violent storm struck with little advance notice. The river suddenly rose to near 28 feet. Army and Navy engineers, the state militia and farmers mobilized by night to bulwark the dike with sandbags. But despite all emergency efforts a portion of the embankment went out, destroying a mile of Great Northern tracks near the estuary. Hundreds of acres were inundated. Moreover, in the wake of the storm came a $1300 bill for sacks used in sandbagging, along with the announcement that the Navy was wondering who was going to pay for a shipment of shovels lost in the flood, an item which entailed much red tape.

In the face of all that, farmers couldn't forget the aftermath of the river rampage in 1934 when a much smaller acreage was flooded. For years thereafter that acreage was so unproductive as to be practically worthless. But there was an encouraging angle when flood waters receded last fall. Organic fields of rye and legumes emerged from the flood in much better condition than adjacent chemicalized fields. The root growths not only prevented much erosion but seemed to dry the land much faster after the run-off. That started many thinking along a new line.

A recent conversation with Mr. Johnson revealed a wholesome philosophy based on a lifetime spent in the valley. "This getting back to organic farming," he said, "is like recovering from a lapse of memory. I remember that the manure pile used to be a big factor in growing healthy crops. But when dairying declined, so did the manure pile. Now, our next best bet is to sheet compost, with rye and legumes returning much to the soil. That, plus raw minerals. But in minerals we have to go against a lot of talk from chemical salesmen.

"Local soil experts neither deny nor condemn the sulphur residue from superphosphate, but of late we're condemning it. We're told that raw minerals are slow acting. All right, so what? Once in the ground, raw rock phosphate and ground limestone will be there just that much longer and no harm done.

Organic advocates say that a single plant of winter rye has 14 billion root hairs—a federal aid committee must have counted 'em—with a total length of 6,000 miles, all right in the ground to be used when broken down by sheet composting. That sounds good to me.

"And if the time ever comes when organiculture fails to show a net—which I doubt seriously—why we can always go back to dairying and the loafing barn. That's what folks are doing in the hilly, lower-priced land surrounding the valley and you don't see any of them on relief."

THE BUSINESS OF FARMING, Degraff and Haystead, University of Oklahoma Press, $3.00.

"This is not a delightful book," say its authors. *The Business of Farming* certainly has little chance of delighting the prosperous, experienced farmer. He will claim that it sounds like a repetition of facts he has either learned himself or read in agricultural bulletins or magazines.

However, the city man with his eye on a place in the country may find it as interesting and delightful as *Robinson Crusoe*. The elementary qualities about it that may bore the practicing farmer should attract the novice in agriculture. Of course, there are quite a few facts and ideas in this book that could be of help to the farmer operating on an insecure economic or practical foundation.

*The Business of Farming* has four sections, namely, soil management, equipment management, labor management and farm organization. Quite properly, the chapters on soil management are placed in a prominent position in the front of the book. The authors show their awareness of the complexity of the soil by placing more than usual emphasis on the soil's biologic life, the importance of organic matter and the futility of relying on fertilizer dumped from a bag.

Although Degraff and Haystead doubt the practicability of the Organic Method in one chapter, in another they say that "... a decline in soil organic matter is a serious form of soil depletion, yet one that is taking place on many farms (possibly a majority) at a rate far too rapid to bode well for the continued success of those farms as going businesses." On the next page they say, "Much attention has already been given to organic matter, and properly so, because among its other values it is the main source of nitrogen to most crop plants."

# HAYING HELPS

## Start Fighting Next Summer's Heat Now

L. H. HOUCK

This is the air-conditioning arrangement Herbert Hahn, Eugene, Mo., built and installed on his hay baler. The bale tie men work with their heads in the sack and see through plastic windows . The rush of air downward keeps the dust and chaff from the hay out of their eyes and also keeps them cool.

L. H. HOUCK

Charles Williams, Nelson, Mo., built a steel frame to hold a canvas awning so he could bale hay in the shade.

## *Memos To Farmers*

### Dogs Are Best Mousers

A cat will play with one mouse while a dog is out catching 75, says Prof. W. Robert Eadie of the Cornell conservation department, in pointing out that millions of dollars worth of damage is done to orchards by mice every year. Farmers who want to keep their orchards free of rodent damage will be wise to install a fleet of terriers and wire guards around all their trees.

### Sherwin-Williams Leaves the Agricultural Chemical Business

The Sherwin-Williams Company has stopped making agricultural chemicals. One of the biggest insecticide producers, Sherwin-Williams lost the "benefits" of 20 years of expensive insecticide research and ignored increasing income on pulling out of the chemical business. A $275,000 agricultural chemical research building had just been completed by the company.

Obviously, Sherwin-Williams must have thought little of the insecticide business to quit while winning. A big factor in the board of directors' decision to stop production was $1,000,000 in damage suits filed against the company as the result of damage incident to the use of weed killers and pesticides. An Arkansas court decision that any agricultural chemical manufacturer failing to label his products with a warning about the risks involved in its use is liable for damages caused by chance, unintentional application, may also have influenced their decision to quit the field.

It is usually sad to watch the retreat of an industry. However, the demise of the Sherwin-Williams insecticide interests brings a pang of gladness to my heart, for this year there will be 7 million less pounds of poison sprayed on our crops.

### A New Pesticide Concept

The Department of Agriculture recently announced the development of a new method of applying insecticides. In an effort to kill greenhouse pests not affected by normal insecticides, the USDA scientists have begun to feed toxic substances to the plants through the soil, thereby making those plants poisonous to insects.

The Department scientists must realize that a diet poisonous to insects is also liable to kill human beings. They are trying to develop these insecticides to such a degree that they will not have an immediate and obvious effect on the people who eat the treated food. However, the putting of even minute quantities of poisons in our diet is going to show up in the statistics of degenerative diseases.

When the basis for our agricultural advancement is the determination of how much poison we can absorb, it is time to decide if we are traveling along the wrong road.

### "How I Practice the Organic Method"

Do you have any ideas about practicing the Organic Method that you think would be of interest to other

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## Memos to Farmers *Continued*

organic farmers? If so, why not write them down in 500 words or less and send them to *The Organic Farmer.* In the interest of spreading information about the Organic Method we are offering one prize of $50, two of $25 and three of $10 for the best entries in this contest.

We want to know the basic foundation of your farming methods. Where do you get extra organic matter? What rotations do you use and how do you work your composting and other fertilization into those rotations? What have been your yields? How have your crops reacted to insect attack? What have you done to control erosion? How much ground rock fertilizer do you use? Has the Organic Method proved profitable for you?

The contest closes May 15. Type out your entries, if possible, and send them to us. The best entries will be published in *The Organic Farmer.*

### Garbage Is to Become A Source of Organic Fertilizer

Composted garbage is about to enter the fertilizer market at a price competitive with commercial fertilizer. Miami, Florida, has already signed a contract with a firm that will construct a $3,000,000 garbage composting installation. Many experiments with composting processes, preparatory to constructing plants, are being held in other American cities.

Of what importance will this new industry be to the American farmer? Obviously, the farmer quite a distance from a city will see mighty little composted garbage. However, most of the farm land in the East and a great deal in the West is close enough to garbage sources to make the shipping of compost economical. The great truck farming sections of New Jersey and Long Island could certainly use a cheap source of high quality organic matter for their sandy soils.

At present, most garbage composting techniques are in the experimental stage. The Verdier process, to be used in Miami, and the Frazer process are the only ones that are developed sufficiently for use on a large scale. The Earp Thomas digester has been in use for years on medium sized projects. Dr. Ehrenfried Pfeiffer has been working on a method of composting garbage in heaps which is almost ready for production use.

A mild dispute is raging between advocates of the heap method and the digester method. Proponents of the heap method claim that the large and expensive digesters will not be able to produce compost economically. They point out that all that is needed for their method is an open field and some handling machinery.

Engineers working with the garbage digester feel just as strongly that their method is superior. Digesters, large tanks with moving arms inside and conveyors to load the raw material and unload the compost, are capable of high production speeds.

The exact method that will be used to compost America's garbage is indefinite, but it is certain that when the concept that garbage is a valuable raw material becomes known, municipalities will not wait long to build composting plants. It is a shame to see our garbage, an organic substance robbed from the soil, being burned and dumped. The men who make possible the utilization of garbage as fertilizer will certainly have done a service to humanity.

R. R.


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# Stone Mulches for Strawberries

**By Wm. Ackerman**

THE practice of mulching strawberries in America dates back largely to the demonstrations of its value with the Jucunda variety about 1865 by John Knox of Pittsburg, Pa. The name *strawberry* indicates that the use of straw in growing the berry is an old practice, however, straw is by no means the only material that may be used advantageously in mulching the plant. The mulching of strawberries is quite common.

To the large commercial grower straw mulch has been and probably will continue to be the standard mulching practice. However, for the small grower outstanding results may be obtained with the stone-mulch method.

How does one start a strawberry bed using the stone mulch method? The ground should first be well plowed or spaded, for this will be the last treatment of the soil in this way as long as the program is continued. Apply a generous dressing of compost. Rows of stone about two feet wide should then be laid with a soil space of about 10 inches width in between. The stones should be dug into the ground a little so that wherever possible a flat surface is up. The level of the soil should be built up even with the stones by bringing additional soil and compost there. The labor involved in handling and laying the rocks is not small, but after once established, the labor will be greatly reduced. One can work it on an extended basis, putting in one section each year until the desired number of sections have been established.

The strawberry plants are planted in the soil rows about two or three feet apart. The blossoms should be removed the first year to enable the plants to become established and produce runner plants.

The stone-mulch plot should be a "permanent" plot. To relocate it every couple of years would entail a great deal of work. By keeping the plants well nourished and properly spaced, and seeing that every plant that has produced a crop is replaced by a runner plant, a vigorous, heavy-bearing strawberry patch can be maintained for many years.

The stone mulch provides such beneficial conditions as the conservation of moisture; good soil aeration; reduction of wind and water erosion on slopes; maintenance of ideal conditions for soil bacteria, earthworms, and burrowing insects; enrichment of the soil by the gradual disintegration of the stone bottoms because of the erosion active of moisture; the protection of the soil from the direct rays of the sun and probably certain beneficial effects of radioactive gamma rays and fluorescent qualities of many types of rocks. Most vegetable crops are adaptable to stone mulching.


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*Poultry*

# Billy The Goose

**By L. R. HILL**

IN OUR rich mountain soil we have always been bothered with that wicked old pest we call "witch-grass". The roots go down to apparently endless depths and spread rapidly in all directions. It is about the first thing to start growing in the spring and keeps growing until the ground freezes up for winter. During a rainy cool spell it can easily overrun almost any planting in a very short time. We had so much trouble with it in our strawberries that we were about ready to give up. We had read hopefully about the new grass killing chemicals; but remembering the losses we had with 2-4D when we used it on the weeds, we didn't want to experiment.

Then we tried geese. After the idea become well developed we asked for a few opinions. Most of our neighbors thought we were too hopeful. Geese, they said, did more damage than good, were dangerous, noisy, and dirty. But we were still hopeful. It was our last straw and like the drowning man we clutched. After the word had gotten around we were in the market for a goose, leads started to come in. Over in Mill Village we found a nice couple who had a gander left from a flock killed by some dogs, and they were interested in finding a home for him. We followed them out to the shed and watched a huge gray gander parade around and eye us with a look I couldn't quite analyze. But our minds were made up. Over the gander's protesting mutters we exchanged the necessary wampum and we owned a gander. He was bound wing and foot and popped into a fish crate through which his long neck and head protruded. His past owners told us his name was "Billy" and bade him farewell. Obviously, he had been the family pet. We set him on the back seat and started home. Billy amused himself on the way by muttering at us, and by sticking his long neck out the window and honking at people along the way.

After we got him home and unloaded, we let him goose step up to the berry patch. Now was the hour. Had we been on a wild goose chase? Never was a goose more closely watched. He eyed the grass carefully and munched a few mouthfuls. Down went a whole dandelion plant, then a kale. But then the powerful bill grabbed a young strawberry plant. Our hopes fell but took a quick lift when he released it and went on to more grass. We brought him out a bucket of water and praised him to the clouds.

So that is how Billy became vice president in charge of weed control at Hillcrest Nursery. We provided him with two geese as companions, and watched our grass and weed problems diminish under their care. They are friendly and like to follow us around when we are working in the nursery. They make fine watch-dogs, honking loudly when anything unusual comes up. We find about the only weed they won't eat is the pusley, and we don't blame them. We keep them shut out of the flowers, the garden and the asparagus. Also out of the strawberry patch when the berries are ripe. They don't eat the berries, but my neighbors were right—geese are dirty. We shut them up at night—against their wishes—because foxes are thick and bobcats drop around now and then. With a little cracked corn as supplement, they live on their work.

## Plants as Indicators of Soil Reaction

(*Continued from page 26*)

Most of the others, particularly the cultivated ones, are members of the intermediate group preferring a soil reaction from 6 to 7. The flora which indicate extreme acidity have not been included here, since they grow on submarginal land which is usually not much good for cultivation.

It is evident that the first group of plants considered (pH 5-6) will not react favorably to liming, while those last listed (pH 6-8) will stand a certain amount of over-liming. There are a number of plants which grow in arid climates where the soils tend toward alkalinity, and these belong to the latter grouping too. The decaying leaves, etc., of the first group will form an acid, raw humus. If their compost is to be used for agricultural and other (garden) crops which do not belong to this group, it is a good idea to add lime while composting.

On the other hand, compost made from plants which are included in the pH 6-8 group will result in a rather neutral humus, even alkaline in reaction in certain cases. Here less lime is needed. If such a compost is to be used for plants in the first group, no lime should be added. This applies mainly to the aerobic compost fermentation; most of the anaerobic bacteria produce acids.

Extremely acid soils are usually deficient in magnesium. There is also the possibility in such cases that soluble aluminum is present, which is very injurious to plant growth. We have already mentioned that an acid humus does not "hold" and so is no protection against washing out and losses of mineral nutriments.

Acid humus layers in waterlogged soils can form a hardpan which is almost impenetrable to the air and plant roots. If these soils are limed excessively, and iron is also present, then an iron calcium compound forms which resists aeration and is hostile to plant roots and usually means the end of deep-rooting plants. Such soils have to be drained and subsoiled before one can begin to cultivate and improve them at all. It is therefore important to study the structure of the subsoil to see if such iron-humus (red brown-yellow) deposits are present. A topsoil analysis alone may not reveal this condition, which is apt to develop under old, low, bottomland pastures. The increase of weeds from the first group on such pastures and the disappearance of clovers are warning symptoms. Liming alone will never remedy such situations, in fact, it even intensifies the illness in waterlogged, *acid* (black) humus soils.

The opposite problem of acidifying an alkaline soil is almost more difficult than leading a moderately acid soil over to the "alkaline" side. Soils which are irrigated often (this also applies to your lawn and small garden which get the "hose" frequently) tend to increasing alkalinity, when more water evaporates than is absorbed. Over-irrigation is very dangerous. Soils in arid climates also tend to be alkaline. Here, an acid humus compost with no lime is indicated. Other means of counteracting alkalinity are moderate amounts of flowers of sulphur and peat. Frequent checks should be made on the soil reaction so that one does not overdo it. A small "test area" should be treated first and then one can find out which method gives the best results.


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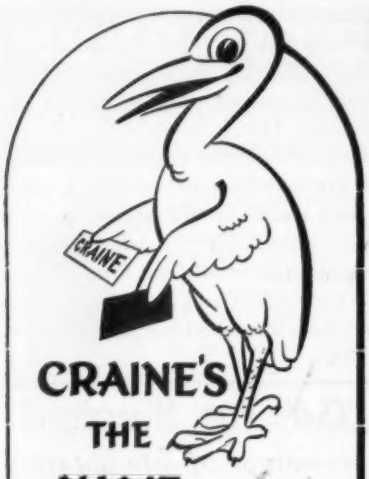


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## Livestock

### Bred Ewes Need Grain Feed Before Lambing

It will pay you well in healthy lambs to get your bred ewes in good condition before lambing time.

Dr. U. S. Garrigus, head of the sheep division of the Illinois College of Agriculture, recommends that ewes get all the good-quality roughage they want from the time they come off pasture in the fall until lambing time.

This roughage may be good-quality legume hay, or it may be corn silage supplemented with ¼-pound of soybean oil meal per head per day with salt and powdered limestone fed free choice. If one-half the roughage is legume hay, enough calcium and protein will be furnished to supplement the corn silage fed as the other half of the ration.

For the last month or six weeks before lambing, Dr. Garrigus recommends adding ½ to ¾ pound of grain mixture to the ration. This grain mixture can be half corn and half oats. To get more protein in the ration if your ewes are in thin condition, add about 10 percent, by weight, of soybean or linseed oil meal. Keep right on with full feed of legume hay.

## Is Any Soil Really Poor?

(*Continued from page* 13)

studies indicated that the iodine had no effect directly on the alfalfa, but did greatly stimulate the inoculating bacteria.

Several years ago C. L. Willis, of the North Carolina Experiment Station, found that either one of a half-dozen trace elements gave measurable crop stimulation when applied to certain Eastern North Carolina soils. The fact that applying just one of these elements had the same effect as applying several or all of them is pretty clear indication that they did not represent a so-called plant-food deficiency.

There are several observations that symptoms of boron deficiency tend to disappear when plentiful organic matter is added to the soil.

We are just coming through a notable era of re-evaluating the land resources of America through plant breeding. We have learned how to build new plant varieties immune or highly resistant to disease. This development has vastly expanded the areas adapted to the commercial production of certain crops. We have also learned how to utilize hybrid vigor. But these better crops need better lands to show their full wares.

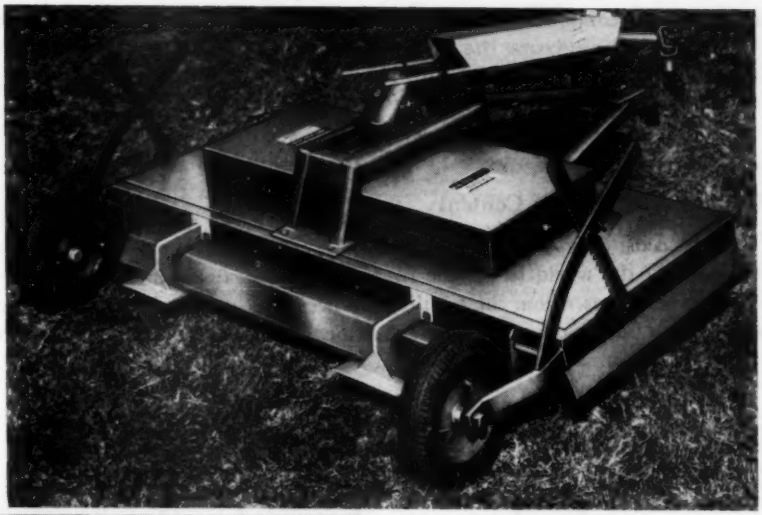
The next big job for our agriculture is the job of soil building. Poor land always curses the man who plows it, but its curse is particularly bitter during high-cost eras. We have been looking at this poor-land menace from entirely too narrow a standpoint, with apparently too orthodox and unbending academic theories. Theory seems way behind empirical discovery. And our scientists have been too reluctant to face the fact that there has long been a mystery about what leguminous organic matter does to effect its enormous push-up of soil in productivity.

The discovery that leguminous organic matter, decaying in the soil, breeds virulent strains of bacteria which destroy the cotton root-rot fungus, ties in with and serves to somewhat clarify the whole hazy concept of what factors may make for soil productivity. Isolated cases are rare, and perhaps non-existent in nature. Everything tends to fall into a pattern. Perhaps there are thousands of unrecognized strains of crop-growth-inhibiting fungous organisms that are similarly destroyed when one of these colossal soil-improvement legumes is doing its land-enriching job.

# The Market Place

### *Wood Bros. Model 50 Rotary Cutter*

Vine, stalk, stubble or brush can be cut at any height from ground level to 14 inches above the ground by the improved Model 50 Rotary Cutter, recently put on the market by Wood Brothers Manufacturing Company. The cutter is mounted on a heavier, stronger, all-steel welded frame. Hardened spring steel blades are available in the plain type and in the suction type, which picks up lodge stalks or vines. They are non-clogging and self-cleaning. The Model 50 can be operated safely on frozen ground.

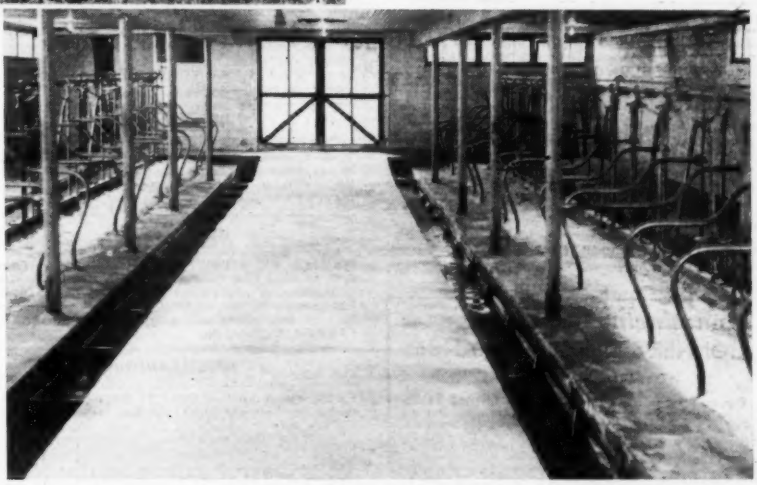


### *Uni-Mower Minneapolis-Moline*

Sickle speeds are easily changed to meet cutting conditions with this Minneapolis-Moline Uni-Mower, which now features V-belt transmission. There are no gears to adjust and fewer wearing parts. The mower is mounted directly on the back of the tractor, and the operator is able to see and avoid an obstruction in ample time to prevent the cutter bar from hitting it. Four inter-changeable cutter bars are available. The Uni-Mower has the attaching hitch-bar as standard equipment.

### *Jamesway Barn Cleaner*

The handling of barn litter is made easier with the time and labor saving Jamesway barn cleaner, which operates on the shuttle stroke principle. Manure is moved toward the outlet opening on the forward stroke. On the return stroke, the paddles fold against the gutter, by-passing the litter. The rate of cleaning is approximately 14 ft. per minute. No cross gutters are required in installation, so a wide variety of adaptations are possible.



## Soils and Proteins

(*Continued from page* 18)

which the farmer can pass on to no one else but which must be passed by him to the soil, has brought our agricultural economics to the point where we are liquidating the capital assets (which is our natural food resource) and calling it profit.

### Soil Maps Are Indicators of Protein Content

One needs only to look at the soil map of the world to see the rather limited areas where the fertility is sufficient to produce hard wheat or to grow protein. These areas are in Central United States, in Soviet Russia and in most of the British possessions. There are none mapped as such in Germany and Italy. When foods of more than mere caloric values are required to win a war, there are suggestions that it was reasons residing in the soils of the different countries that classified them as the victors or the vanquished. It is no great stretch of the imagination to see who the present great powers are in terms of soils that produce protein-rich foods. Can it be beyond the elastic limit of the imagination to see the world problem as mainly a food problem when once the soil fertility pattern is understood and when we remember that more than only calories and bulk are required of the foods that really dispel hunger? If we are to carry the major part in providing proteins for war-torn peoples whose older soils have dwindled in their capacity to grow such quality foods or even to provide oils and fats, shall we not approach that responsibility cautiously and raise the question whether we do not need conservation of our own soils in a degree never yet contemplated?

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